Northwest
Territories Renewable Resources
Pollution Control Division

Review and Evaluation of Equipment for Utilizing Waste Oil as a Fuel for Heating in the N.W.T.

March 1988

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April 12, 1988
File: 102-004-80

Mr. Neill Thompson
Senior Environmental Protection Inspector
Government of the Northwest Territories
Renewable Resources
Yellowknife, N.W.T.
X1A 2L9

Dear Sir:

Re: Review and Evaluation of Equipment for Utilizing Waste Oil as a Fuel for Heating in the Northwest Territories

We are pleased to submit the final report for the above study. This report examines the heating equipment available that can utilize waste oil as a fuel. The various options were evaluated with particular attention to their suitability for installation into remote northern communities.

We appreciate having had the opportunity to work on this very interesting and worthwhile study.

Yours truly

BOREAL CONSULTING SERVICES LTD.

DM/ks

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May 05, 1988
File: 102-004-80

Mr. Neill Thompson
Senior Environmental Protection Inspector
Government of the Northwest Territories
Renewable Resources
Yellowknife, N.W.T.
X1A 2L9

Dear Sir:

Re: Review and Evaluation of Equipment for Utilizing Waste Oil as a Fuel for Heating in the Northwest Territories

Subsequent to our release of the final report, we received additional information that we felt should be included in this report.

In attempting to obtain current data on the Kroll line of waste oil furnaces, an importer of Kroll furnaces was made aware of this study. Although he is the Canadian representative for the Kroll furnaces, he has begun manufacturing an atomizing-type furnace under the name of Multi-Fuel and we have included this product literature for insertion into the report. The furnace appears to be a standard furnace manufactured by York Shipley and furnished with a waste oil burner of his own manufacture. The details in the product literature are very sparse but it appears that the burner requires an external air source and that it has not been tested or listed by U.L.C.

From discussions with Mr. Kintz of Multi-Fuel, we were made aware of an additional criteria that could be incorporated into the Value Engineering Study. This criteria is safety. Although he may be somewhat biased now that he sells atomizing units, he indicated that vapourizing units have a risk of exploding when being restarted after the daily cleaning. There may be some basis to this concern if an operator allowed fuel to enter a hot combustion chamber capable of vapourizing some of the fuel before a match or some other source of flame was applied to light the oil. We contacted Mic Mac Motors in

Continued....

Whitehorse, who have used a vapourizing furnace for three years and they confirmed that it was possible to cause an explosion if the operator over-rode the controls and tried to relight before the unit cooled down or used a very volatile fuel when relighting. They admitted the risk was there but only if the operator did not follow operating instructions properly. They emphasized that they felt the key to the successful and safe operation of either type of furnace is that the owner/operator must be prepared to operate it properly and be dedicated to preventative maintenance.

Yours truly

BOREAL CONSULTING SERVICES LTD.

D. McLaughlin, P.Eng.

DM/ks
Encl.

Northwest
Territories Renewable Resources

13 457 059

26 July 1988

**Review and Evaluation of Equipment for Waste Oil
As a Fuel for Heating in the Northwest Territories**

Suspension of CSA Authorization and Recall Notice for Lanair Model L-220E

Enclosed is a copy of a letter from the Canadian Standards Association suspending CSA authorization and a recall for the Lanair Model L-220E Used Oil Heater. In this publication the unit is listed in Section 3.2.2 and is distributed by Solv-X Inventions Ltd.

The complete letter is listed in the Miscellaneous section of Appendix "B".

Neil

Neill Thompson
Senior Environment Protection
Inspector
Pollution Control Division

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1. INTRODUCTION

Waste lubricating oil is being generated in Canada in alarming quantities. Although not a new problem, there is growing concern for the ways in which this oil is being discarded. The Northwest Territories, like the rest of Canada, has expressed particular concern regarding the current, common disposal methods of road oiling, indiscriminate burning and careless dumping. In many northern communities, waste oil is accumulating in old fuel drums and storage tanks until a practical disposal method can be found. Aside from the serious environmental impact of this contaminated oil, as a petroleum product, waste oil represents a valuable source of energy. Like gasoline and fuel oil, it is a non-renewable natural resource and should not be wasted. Energy, Mines and Resources Canada encourages re-refining as the preferred method of waste oil disposal and, in an April 1982 letter to the Department of Energy and Mines, Province of Manitoba, stated that they would not endorse waste oil burners as there is no control on emissions. A telephone call to the local office of Energy, Mines and Resources Canada confirmed a continued reluctance to participate in burning waste oil even though EMR participated in a CREDA project at Carol Automotive, Labrador City, Newfoundland, in 1985. (Ref. 1.) Re-refining is obviously only practical near very large populated centres.

By carefully controlled burning of the waste oil at its source within the community, and by utilizing the resultant heat, northern communities will benefit in at least three ways:

i) The high cost of storing or transporting waste oil is eliminated.

ii) The contamination of the environment by uncontrolled disposition is reduced.

iii) Dependence on expensive fuel oil is lessened.

To put the magnitude of the waste oil problem into perspective, it has been estimated that a potential exists to recover 259,000 litres of waste oil each year from the Yellowknife area alone (Ref. 2.). That represents almost 10,000 GJ of energy: enough to heat twenty buildings (2500 sq. ft. each) for an entire Yellowknife winter. To tap this significant resource, a number of waste oil burning appliances are available in Canada. This report contains a comprehensive list of the available equipment together with a brief evaluation of each product. Most of the products listed are approved by one or more of the major testing facilities in North America. The conclusions of the report, developed from the value engineering results and the experience of a number of case studies, provide recommendations as to the most suitable equipment and highlight important installation features to be considered. Copies of the product literature supplied by the manufacturers are included in Appendix "B".

2. WASTE OIL APPLIANCES: OVERVIEW

There are, basically, two different burner technologies used in waste oil burning appliances, dividing the products into two distinct categories. Categorizing the appliances by the firing method used, there are: atomizing units, which mechanically reduce the oil to small particles for combustion; and vapourizing units, designed to preheat the oil to its vapourizing point, burning the oil vapour. All oil burning appliances are variations on one of these two principles.

2.1 Atomizing Oil Burner Type

People will likely be more familiar with the atomizing type unit since the vast majority of domestic fuel oil furnaces (over 95%) use high pressure atomizing type gun burners. In these units, oil at 100 to 300 psi is supplied to a nozzle orifice which breaks it into a fine mist and swirls it into the combustion space as a cone-shaped spray. To reduce problems with nozzle plugging and nozzle wear from fine suspended particles in the waste oil, some burners use lower pressures and nozzles with a larger orifice. This type of burner achieves atomization by injecting a small amount of compressed air into the oil stream prior to its discharge through the nozzle. The compressed air is supplied either by an external source such as a shop compressor or a compressor dedicated to the furnace or, in the case of the Black Gold burners, a small integral air pump. Combustion air from a fan is forced through the burner air-handling parts surrounding the oil nozzle and is directed into the oil spray. Thus, an intimate mixture of oil and air is produced which is ignited, usually by a high voltage electric spark.

Steam atomizing oil burners operate in a similar manner to the air/oil lower pressure gun burners described above. However, in this case, atomization is accomplished by the impact and expansion of steam. Oil and steam flow in separate channels through the burner gun to the nozzle where they mix before discharging through an orifice into the combustion chamber. Combustion air is supplied in a similar manner to the preceding burner type. Oil pressure at the burner inlet is generally between 100 and 150 psi with steam pressure some 25 psi higher.

Yet another type of atomizing burner, originally developed to burn bunker oil but now adapted to burn waste oil, is the horizontal rotary cup burner. The burner atomizes the oil by spinning it in a thin film from a horizontal rotating cup and injecting high velocity primary air into the oil film through an annular nozzle. Rotary cup burners have been used to retrofit conventional fire tube boilers for burning waste oil.

2.2 Vapourizing Oil Burner Type

Less common in domestic installations than atomizing units, vapourizing burners work on the principle that the combustion process provides enough heat for vapourization of the oil. The oil vapour, mixed with the right amount of air, is in turn ignited either electrically or by a manual pilot. Once the vapourization process has started, combustion is self-sustaining. The unit is usually started by manually igniting a small amount of #2 heating oil in the vapourizer pan. When the temperature of the burner pot reaches a preset temperature, about 120°F for the Lanair furnace (Ref. 3), the waste oil is allowed to flow from the fuel tank into the vapourizer pan, where it is immediately vapourized. The ignition of the air/fuel vapour mixture produces enough heat to vapourize more fuel in a self-sustaining process.

2.3 Comparing Atomization and Vapourization

The primary difference in the two combustion methods is the way the fuel is prepared for ignition. The atomizing burner turns the oil into a fine mist of very small particles while the vapourizing burner produces an oil vapour of much larger particles. This difference produces significantly different operating characteristics for each unit regarding required maintenance, types of emissions, unit efficiency, reliability and capital costs.

2.3.1 Required Maintenance

Because the oil in a vapourizing type furnace is heated to vapourization in a pan or pot burner, a residue of unburned material accumulates in the bottom of the fuel pot and must be removed daily. After removing and cleaning the fuel pot, the unit must be re-started by manually igniting a small amount of heating fuel or diesel oil (about 1-2 cups) in the clean pot. Although each manufacturer makes their own claims, discussions with owners of vapourizing units indicate daily maintenance usually takes about 15 minutes

Atomizing units do not require daily cleaning. With this type of burner, most of the fuel is burned and discharged as stack effluent, eliminating any significant accumulation of ash or unburned residue. As a very general rule, atomizing type units require weekly maintenance to change filters and monthly maintenance to clean the burner nozzle. Furthermore, a major internal cleaning is usually required once a year and is likely to take 5 or 6 hours.

2.3.2 Air Pollutant Emissions

The combustion of waste oil in both atomizing and vapourizing burner types results in the discharge of high levels of metallic species. Because atomizing burners discharge most of the burnt fuel as stack effluent, they have much higher stack emission levels than vapourizing pot systems. Furthermore, particulate loading levels (inorganic material) are usually about ten times higher for atomizing burners than for vapourizing burners. The waste residue produced in the pot of vapourizing burners contains the majority of its elemental emissions (Ref. 4).

A 1983 study by the U.S. Environmental Protection Agency (EPA) states that, after burning waste crankcase oil, emissions of several toxic or carcinogenic metals were found at elevated levels in both the flue gas stream from the atomizing burner and in the residues from the vapourizing pots. In particular, the study makes a positive correlation between the percentage of automotive crankcase oil (non-diesel engines) and the concentrations of lead in the burner emissions. In one particular test using an atomizing unit burning automotive crankcase oil, lead emissions were 1000 times higher than the 8-hour American Conference of Governmental Industrial Hygienists Threshold Limit Values (Ref. 4). Therefore, a leaky flue or direct exposure to the flue gas could produce an elevated exposure to lead from this source.

Clearly, when considering emissions discharged to the atmosphere through flue gas effluent, the atomizing burner units represent a far greater potential hazard than do vapourizing pot burner units. However, the waste residue that accumulates in the pot burner units contains significant quantities of the same toxic and carcinogenic substances found in the flue gas of the atomizing units. This residue must be handled on a daily basis when cleaning the vapourizing unit, exposing the user to an elevated health risk. Although the unit emits much lower levels of organic and inorganic pollutants to the air, the waste residue generated in the vapourizing pots must still be disposed of in an environmentally sound manner.

Lead emissions, although still a potential health hazard, have been drastically reduced in recent years due to fewer vehicles using leaded gasolines. A recent EPA survey discovered that waste oil sampled from a Chicago hauler contained lead concentrations of around 60 ppm. This was compared to levels approaching 600 ppm in 1981. Furthermore, in the North, waste oil will likely contain large proportions of diesel crankcase oil which is very low in lead concentrations. The November 29, 1985 EPA Used Oil Final Rule encourages recycling of used oil by burning it on site to heat your building.

Summarizing, if the waste residue from vapourizing pot burners can be handled safely and disposed of properly, this method appears to represent less of an environmental risk than the atomizing burner units. The volume of waste residue typically produced by a Lanair L-220-E during a 24-hour day is slightly less than one litre while consuming approximately 103 litres of waste oil.

2.3.3 Combustion Efficiency

All hydrocarbon fuels require a certain amount of air to allow the combustion process to occur. The amount of air required is called theoretical air and may be determined for each fuel using a combustion equation. Excess air, in addition to that theoretically required for combustion, must be supplied to most practical combustion systems to ensure that complete combustion is achieved. The excess air at which a process operates has a significant effect on its overall efficiency. If too much excess air is provided to the fire box, more air than necessary is heated and escapes in the flue gas. On the other hand, too little excess air may result in incomplete combustion and a loss of unburned combustible material in the flue gas. Excess air may be varied from 5 to 50 percent, depending on the type of fuel and combustion equipment. Generally, atomizing burners achieve more complete air fuel mixing and are capable of operating at a lower excess air level than vapourizing pot burners. Thus, atomizing type furnaces usually attain higher operating efficiencies than the vapourizing type furnaces.

Another point worthy of consideration is the fact that most vapourizing type furnaces operate in either a fully on or fully off mode. Some models of vapourizing furnaces have a variable firing rate. Although they can never be turned completely off, they can be reduced down as much as 50% of full firing rate. This change of firing rate can be controlled thermostatically to give some automatic reduction in heat output. When the outdoor temperature is warmer than the design minimum output for the vapourizing unit, heated areas will become too warm. To control the temperature, doors, windows and exhaust fans are used to let the excess heat escape, wasting some of the heat produced. Obviously, atomizing furnaces are more efficient in this situation.

2.3.4 Reliability

From review of the case studies in Appendix "A" and discussions with other waste oil furnace owners, it is quite clear that vapourizing type units are more reliable than atomizing type units. Although the vapourizing pot burners require more routine maintenance, they also experience fewer operating problems and shorter unforeseen downtimes. This observation is to be expected, considering the fact that atomizing burners are much more automated and have far more moving parts than vapourizing units. Atomizing burner nozzles are more prone to clogging and fouling than the simpler vapourizing injectors.

The associated equipment, such as oil storage tanks and fuel pumps, are similar for both types of units and achieve similar reliabilities.

2.3.5 Costs

The vapourizing heaters generally have a lower capital cost than the atomizing furnaces. Furthermore, a couple of the vapourizing heaters come complete with fuel tank, eliminating the need for the purchase of any additional components. One important factor to remember when considering the purchase of an atomizing furnace is the requirement of an external compressed air supply for some models. If a compressor is not available for use with the unit, one will have to be purchased, adding considerably to the capital investment required.

3. AVAILABLE PRODUCTS

The search for manufacturers of waste oil burning appliances concentrated on those firms operating in North America. Three waste oil furnace manufacturers are in operation in Canada, including one operating under licence from a firm in the United States, and a second assembling one model of a furnace from a West German manufacturer. There are at least two other West German manufacturers and one manufacturer in Holland. By contacting all the major testing and approval agencies in North America, we were also able to make contact with five other waste oil furnace manufacturers in the United States, located primarily in Pennsylvania and Wisconsin.

We feel we have compiled a comprehensive list of all the products manufactured in North America that are designed to burn waste oil. There are, to our knowledge, no other waste oil furnace manufacturers in Canada or the United States. We were also able to locate only a single manufacturer of waste oil boilers in North America. The manufacturer has installed an air-atomizing burner in an approved fire-tube boiler which has been modified slightly to burn waste oil. Furthermore, we were able to locate a Canadian company that manufactures a burner capable of burning waste oil that can be used to convert an existing boiler to one that utilizes waste oil as its fuel.

All the available products are listed using the manufacturer's name, trade name, and model number. The products are divided into categories by the type of combustion technique used (i.e. atomization and vapourization).

Unfortunately, in our case studies, we were only able to observe the operation of the Canadian-made products and have little information on the actual operational performance of the American-made products. Refer to Appendix "B" for copies of the product literature.

3.1 Atomizing Furnaces

Note: All prices are given in Canadian funds.

3.1.1 "Black Gold" by Black Gold Inc. (Waupaca, Wisconsin)

Model: BG150XL
Rated Input: Up to 150,000 Btuh
Oil Consumption: 1.10 USGPH
Cost: $5,064

Model: BG200
Rated Input: Up to 200,000 Btuh
Oil Consumption: 1.43 USGPH
Cost: $5,456

The Black Gold units are designed to burn waste crankcase and lube oils, automatic transmission oils, and #1 and #2 heating oils. Smaller nozzle orifices would be required for burning #1 and #2 heating oils. Both units can be used in conjunction with heating ducts, are thermostatically controlled, and feature efficient flame retention burners. The most distinctive feature of both units is that they have an integral air compressor. Thus, no compressed air from the shop is required, avoiding the need to run a large shop compressor overnight.

Also included in the purchase price is a fuel transfer pump to lift oil to the furnace from a remote fuel source such as a floor mounted day tank. Although without any Canadian approvals, both units are listed by UL and ETLM (see Section 4. - Approved Agencies) in the United States.

3.1.2 "Clean Burn" by Clean Energy Inc. (Leola, Pa.)

Model:	CB-86-AA
Rated Output:	75,000 Btuh
Oil Consumption:	0.7 USGPH
Compressed Air Required:	1.5 cfm @ 20 psi
Cost:	$2,853
Model:	CB-86-AH
Rated Output:	150,000 Btuh
Oil Consumption:	1.33 USGPH
Compressed Air Required:	2.0 cfm @ 20 psi
Cost:	$3,894
Model:	CB-86-BH
Rated Output:	225,000 Btuh
Oil Consumption:	2.0 USGPH
Compressed Air Required:	2.0 cfm @ 20 psi
Cost:	$5,064

Clean Burn furnaces are all designed to burn a number of different fuels. The furnaces can burn used crankcase oil and transmission fluid as well as #1 and #2 fuel oil. The heat exchangers are made of heavy-duty, 11-gauge stainless steel and feature efficient flame retention burners. All the units can be automatically controlled by a remote thermostat.

Two of the three units (CB-86-AH and CB-86-BH) can be ducted while the third (CB-86-AA) is only a unit heater type. An oil transfer pump for use with a remote fuel source is standard with each unit. However, a separate source of compressed air is required for operation of these furnaces.

All three units are listed in the United States with ETLM. No Canadian listing has been sought as yet.

3.1.3 "Econo Heat" by Reznor (Waupaca, Wisconsin)

Model: RA/230
Rated Output: 184,000 Btuh
Oil Consumption: 1.5 USGPH
Cost: $4,543

Model: RAD 230
Rated Output: 184,000 Btuh
Oil Consumption: 1.5 USGPH
Cost: $4,543

Model: RA 118
Rated Output: 94,000 Btuh
Oil Consumption: 0.85 USGPH
Cost: $3,764

Model: RAD 118
Rated Output: 94,000 Btuh
Oil Consumption: 0.85 USGPH
Cost: $3,764

All four Econo Heat models are UL listed to burn used crankcase oil, gear case oil, transmission fluid, brake fluid, hydraulic oil and both #1 and #2 fuel oil. The two models designated "RAD" can be used with heating ducts. All four models can be automatically controlled by a remote thermostat and have high retention head burners.

A unique feature of these units is the choice of two atomizing techniques. One can opt for either the hydraulic pressure atomization burner or the more common low air pressure atomization burner. A separate water pump is required for the hydraulic burner while an air compressor would be required for the pneumatic burner.

3.1.4 "Lanair" by Lenan Corp. (Janesville, Wisconsin)

Model: CA-200C
Rated Output: 200,000 Btuh
Oil Consumption: 1.25 USGPH
Cost: $6,308

Model: CA-110

Rated Output: 100,000 Btuh

Oil Consumption: 0.75 USGPH

Cost: $3,886

Model: CD-150

Rated Output: 150,000 Btuh

Oil Consumption: 1.07 USGPH

Cost: $4,995

Model: MF-150

Rated Output: 150,000 Btuh

Cost: $5,295

The Lanair models listed above, with the exception of the MF-150, are all designed to burn used crankcase oil, transmission fluid, and both #1 and #2 fuel oil. They are all ceiling hung and fully controllable by a remote thermostat. Ducts may be used with the CD-150. The CA-200C and the CD-150 are UL listed; the CA-110 is PFS listed. All three are approved for use in Manitoba.

The MF-150 is a unique heater, designed to burn wood, coal, used crankcase oil and transmission fluid, fuel oil, natural gas and propane. Intended for installations where the supply of used automotive oils is insufficient to warrant a waste oil furnace, the MF-150 is ductable, thermostatically controllable and PFS listed.

Each of the Lanair heaters requires the purchase of additional equipment such as a fuel transfer pump ($295), water separator ($94), air regulator ($72) and remote fuel tank.

3.1.5 "Sunfire" by Flametech Manufacturing Inc. (Elmira, Ontario)

Model:	FLA 175
Rated Output:	175,000 Btuh
Oil Consumption:	1.2 USGPH
Cost:	$5,650

Model:	FLA 350
Rated Output:	350,000 Btuh
Oil Consumption:	2.4 USGPH
Cost:	$7,450

Model:	FLA 495
Rated Output:	495,000 Btuh
Oil Consumption:	3.4 USGPH
Cost:	$9,550

By far the most common atomizing waste oil furnaces in Canada because of their ULC approval, the Sunfire units FLA 350 and FLA 495 are both ductable and thermostatically controllable. The FLA 175 model is not approved, as yet, for use in Canada. All the Sunfire models are designed to burn used crankcase and transmission oil, heavy equipment oil, and #1 to #4 fuel oils.

Efficient flame retention burners are used in all Sunfire furnaces. A reciprocating air pump is an optional equipment used to lift oil from a day tank to the elevated furnace. Furthermore, a compressed air supply is required for operation of the furnace. Although the product literature claims that filters need only monthly changes, installations we have observed suggest the filters require bi-weekly changes. It is likely that other units making similar claims will also find their filters fouling up more frequently in actual installations. As a further note, the burner nozzle on these units seems to foul up periodically, requiring semi-annual cleaning. Again, it is likely that other atomizing units, since their burners are all fairly similar, will also require semi-annual purging. Unfortunately, the Sunfire units are the only ones we have been able to observe in the field.

3.2 Vapourizing Furnaces

Note: All prices given are in Canadian funds.

3.2.1 "Kutrieb" by Kutrieb Corp. (Chetek, Wisconsin)

Model: Advanced 250
Rating: 250,000 Btuh
Oil Consumption: 1.8 USGPH
Cost: $3,182

Model: CTB-87
Rating: 87,000 Btuh
Oil Consumption: 0.63 USGPH
Cost: $1,167

Model: HT-87
Rating: 87,000 Btuh
Oil Consumption: 0.63 USGPH
Cost: $1,167

Undoubtedly the simplest and least expensive of the waste oil appliances, the Kutrieb vapourizing heaters are primarily intended for use as space heaters. However, the Advanced 250 can be adapted for use with duct work. They are designed to burn waste crankcase and transmission oils, heavy diesel oil and #1 and #2 fuel oils.

The simplest of the Kutrieb heaters, the CTB-87, is completely self-contained. A six-gallon fuel tank is attached directly to the side of the heater, eliminating the need for a remote fuel source. Furthermore, because it is a vapourizing unit, a supply of compressed air is not required. The unit has two settings: high fire and low fire. A wall-mounted controller is supplied to switch the burner between these two firing rates. The manufacturer also claims that the unit can be operated continuously for up to 60 hours before the ash must be removed. Unfortunately, we were unable to confirm this in practice. Our experience with another type of vapourizing unit suggests daily cleaning may be required.

The other two heaters are also very simple. However, unlike the CTB-87, they require connection to a remote fuel source. Another feature of all the Kutrieb heaters, inherent to vapourizing units, is that they require manual starting. This eliminates the need for automatic controls that can fail but increases the time and effort involved in operating these heaters.

One drawback of these units is that all the major testing facilities in the United States have refused to list vapourizing-type waste oil furnaces.

3.2.2 "Lanair" by Solv-X Inventions Ltd. (Winnipeg, Manitoba)

Model:	LV-110
Rated Output:	100,000 Btuh
Oil Consumption:	0.68 USGPH
Cost:	$3,500

Model:	L-220E
Rated Output:	200,000 Btuh
Oil Consumption:	1.21 USGPH
Cost:	$5,650

The Lanair Models LV-110 and L-220E are manufactured in Winnipeg through a licencing agreement with Lenan Corporation of Janesville, Wisconsin. These vapourizing heaters are designed to burn waste crankcase oil, gear oils, transmission fluid, and #1 and #2 fuel oils. The units have both CSA and PFS certification.

Both of the Lanair heaters have forced air blowers and must be connected to a remote fuel source. However, since they are vapourizing units, compressed air is not required.

We have observed several of these units in operation and have found them to be very reliable. Their owners have experienced no difficulties in burning a wide range of waste oils. The heaters do, however, require daily maintenance to scrape the residue from the vapourizer pan. Another disadvantage of the unit is its inability to modulate its heat output. Once the unit is started, it remains at a constant firing rate until it is shut down. Manual restart is then required.

3.2.3 "Kroll" by Kroll GMBH, (Kirchberg/Murr, West Germany)

The Kroll line of vapourizing heaters is represented in Canada by Multi-Fuel, 320 Bell, Cowansville, Quebec. The Model K410 is manufactured (i.e. a combination of imported components and locally manufactured components) by a plant in Quebec.

Model: W400L, W400VL, W400H2Z
Rating: 60,000 to 120,000 Btuh
Oil Consumption: .5 to .75 gal/hr.

Model: K410 (Produced in Canada)
Rating: 65,000 to 125,000 Btuh
Oil Consumption: .5 to .75 gal/hr.
Cost: $4,700

Model KT800
Rating: 160,000 to 240,000 Btuh
Oil Consumption: 1.0 to 1.5 gal/hr.

Model: KT1000
Rating: 270,000 to 380,000 Btuh
Oil Consumption: 1.7 to 2.4 gal/hr.

Only the model K410 is actively marketed in Canada, although it may be possible to import the other models if necessary. It is a wall or ceiling hung unit heater style with a warm air blower. The model W400L is the simplest model and is basically a floor-mounted gravity space heater. The W400VL adds a small warm air blower to better distribute the air in larger areas. The W400H2Z has a water heat exchanger that allows the unit to heat domestic water or to supplement existing boiler capacity. The models KT800 and KT1000 are floor-mounted unit heater style furnaces with a warm air blower. All models have two rates of oil injection to provide a high and low level of heat output. The KT series of heaters has an ash removal system that allows the pot residue to be removed without shutting down the burner.

3.3 Boiler Conversion Burners

3.3.1 "Low-Pressure Vortex Burners" by Trecan Limited (Mississauga, Ontario)

Model:	LPV-1
Rating:	1.3×10^6 Btuh
Cost:	$5,000

Low-Pressure Vortex (LPV) burners are manufactured in Canada by Trecan, under licence from Trane-Thermal Company of Pennsylvania. The burner uses either steam or compressed air to atomize a wide range of fuels, including most waste automotive oils. By fitting an LPV burner in a conventional fire-tube boiler, one can use waste oil to supply hot water or steam for use in a hydronic heating system.

After contacting approval authorities in both the Yukon and the Northwest Territories, it appears that obtaining certification for such an installation is possible, providing that both the boiler unit and the LPV burner have their own CSA approvals. The large capacity and high cost of these burners makes them impractical for all but very large operations with great quantities of waste oil available.

3.4 Boilers

3.4.1 "Clean Burn" by Clean Energy Inc. (Leola, Pa.)

Model: B-5000
Rating: 500,000 Btuh
Oil Consumption: 3.8 USGPH
Cost: $11,915

Model: B-6000
Rating: 680,000 Btuh
Oil Consumption: 4.7 USGPH
Cost: $12,315

Model: B-8000
Rating: 800,000 Btuh
Oil Consumption: 5.5 USGPH
Cost: $13,090

Model: B-9000
Rating: 930,000 Btuh
Oil Consumption 6.4 USGPH
Cost: $13,512

The Clean Burn waste oil boilers are the only boilers in North America specifically manufactured to burn waste oil. The manufacturer, Clean Energy Inc., also manufactures waste oil furnaces. It appears that they have modified their air-atomizing furnace burners to operate at slightly higher air pressures for use in a fire tube boiler.

The boiler is built to the American Society of Mechanical Engineers' (ASME) requirements and the burner is ETLM listed to burn waste crankcase oil, transmission fluid as well as #1 and #2 fuel oil. The unit can be used in either hot water or low pressure steam heating systems. As with all atomizing burners, a supply of compressed air is required.

Auxiliary components such as fuel tanks, pumps and filters, will require a similar maintenance schedule to the Clean Burn furnaces (Section 3.1.2). However, it is not clear how often the tubes of the boiler will need cleaning.

The price indicated previously includes all components such as an oil transfer pump, filters, strainers and check valves.

4. APPROVAL AGENCIES

Canadian Testing Authorities

1. Canadian Standards Association (CSA) - (416) 747-4000
2. Underwriters´ Laboratories of Canada (ULC) - (416) 757-3611

American Testing Authorities

1. Underwriters´ Laboratories Inc. (UL) - (312) 272-8800
2. Energy Testing Laboratories of Maine (ETLM) - (207) 799-7303
3. Product Fabrication Services (PFS) - (608) 221-3361

The only approval required to install and operate an oil burning appliance is that of the local fire marshal. However, local fire marshals cannot possibly be expected to test every piece of equipment proposed for installation in his/her jurisdiction. Fire marshals in Canada, therefore, rely on registered testing facilities (i.e. CSA and ULC) to publish a list of products that meet or exceed recognized safety requirements. Since a local fire marshal will very rarely approve an installation which uses a product not already carrying CSA or ULC certification, it may be difficult to get authorization to install any of the American-made appliances. None of the American-made units has either CSA or ULC approval. CSA indicated that they are not allowed to certify atomizing type furnaces because of the higher levels of pollutants in the flue gas.

Despite the similarity in names, ULC and UL are completely separate entities without any financial, legal or other connection. The two do, however, maintain some technical liaison on matters of mutual interest. A recent ruling by ULC has made it possible to get products with a UL listing approved for ULC listing without having to be retested. The ruling is applicable provided that ULC recognizes and approves of the testing method used by UL.

5. VALUE-ENGINEERING STUDY

Value-engineering is a mathematical method of evaluating a group of competing options against a variety of criteria with differing relative importance. In this study, we have several competing makes and models of furnaces to evaluate against a specific set of criteria. The criteria selected will not necessarily be of the same importance when trying to select the best option. For example, in this study emissions are considered to be more important in the decision making process than controllability. Each criteria is assigned a numerical weighting, depending on its importance relative to the other criteria. In turn, each option is evaluated by individually evaluating and scoring its performance in each criteria. The scores are multiplied by their criteria weight to provide a weighted score and totalled for each option. The option or options receiving the highest total are considered the best suited to meet the requirements.

5.1 Evaluation Criteria

In comparing waste oil heaters, the important factors to be examined were determined to be as follows:

- capital cost
- operating and maintenance costs
- ease of operation
- controllability
- reliability
- emissions
- efficiency

By assigning each of these factors a relative importance, they become the criteria used to evaluate the waste oil heaters.

5.1.1 Capital Cost

Capital cost is based on the list price of the unit and any required accessories. Some heaters require the purchase of fuel transfer pumps and filters while others have to be connected to a supply of compressed air. These requirements obviously add to the capital cost of the heater. The cost of extras such as duct work and controls is not included.

Because of the relatively short paybacks generally provided by waste oil heaters, the capital cost criteria was not considered to be of vital importance. Capital cost was assigned a weight of 2.

5.1.2 Operating and Maintenance Costs

Operating costs include such items as the cost of running an oil transfer pump, an electric oil preheater and a compressor to supply air to the burner. With the high cost of electricity in remote arctic communities, these costs can become significant.

Maintenance costs consider replacement parts, filter changes and, most importantly, the labour involved in daily, monthly and annual maintenance.

As an evaluation criteria, operation and maintenance costs were assigned a relative weight of 3.

5.1.3 Ease of Operation

Recognizing that building owners would ideally like to install a waste oil heater, start it up, and forget about it, a unit that requires careful monitoring or complicated start up procedures is definitely undesirable. Although difficult to judge quantitatively without site observations, a heater's ease of operation is directly related to the amount of maintenance required. Generally, vapourizing type heaters will require daily cleaning and restarting, making them more difficult to operate. This criteria received a weight of 3 for the value-engineering study.

5.1.4 Controllability

As stated earlier in the report, an important feature of the atomizing type heaters is that they can cycle the burner on and off to satisfy a remote thermostat. On the other hand, vapourizing units operate fully on until they are shut off manually or, at best, provide a high-low firing rate of about 2-1. Once shut down, they then require manual restarting.

In order to avoid constantly restarting the vapourizing heater, it is usually allowed to operate all day. To modulate the temperature in the heated space during warmer weather, doors, windows and exhaust fans are used to expel excess heat. While these methods may work quite well, they undoubtedly make the installation very inefficient. Feedback from the thermostat of the atomizing furnace prevents the space from overheating while burning only enough oil to maintain the desired temperature.

Although their lack of controllability makes the vapourizing heaters less efficient, the primary objective of waste oil appliances is to dispose of the oil in a safe manner. Thus, the controllability criteria was assigned a weight of 2.

5.1.5 Reliability

Appliance reliability assumes considerable importance in the remote communities of the Northwest Territories. Specialized and skilled repair personnel are rarely available within the community. Instead, tradesmen and replacement parts must be flown in at considerable expense to the appliance owner. Furthermore, downtime caused by equipment failure is often significantly longer in the North.

For the value-engineering study, product reliability was judged by its complexity. The more complex units have more moving parts and have a higher probability of failure. Of course, this is not always true. However, having only been able to observe installations of Canadian-made products, appliance complexity provides the best available basis for judging reliability. This criteria received an importance weighting of 3.

5.1.6 Emissions

Section 2.3.2 outlines the comparative air pollutant emissions from both atomizing and vapourizing type waste oil heaters. Recent literature makes it clear that atomizing burners produce much higher levels of air pollutant emissions in the stack effluent than vapourizing pot burners. Particulates from vapourizing units are concentrated in a residue that must be cleaned out each day. The bottom line is that, if the waste residue from pot burners can be handled safely and disposed of properly, they represent less of an environmental risk than the atomizing furnaces.

It is probable that, within the two categories of burner types, each product will have slightly different emission characteristics. However, there is no literature available to quantify these differences. As a result, the emission characteristics of each waste oil heater have been evaluated simply by whether or not it employs a vapourizing or atomizing burner. The vapourizing burners have been identified as producing fewer harmful emissions.

Lessening the environmental impact of waste oil disposal is the primary objective of using waste oil heaters. This is reflected in assigning the emission criteria of the value-engineering study the highest relative weight at 4.

5.1.7 Efficiency

A furnace's efficiency depends on two basic factors of its performance. The first factor, controllability, has already been described in Section 5.1.4. The second factor, which was discussed in Section 2.3.3, is combustion efficiency. Combustion efficiency is basically the units of usable heat produced by the furnace divided by the units of heat inputed as fuel. Atomizing type furnaces usually attain higher combustion efficiencies than the vapourizing type furnaces.

These two factors combine to make atomizing furnaces significantly more efficient than vapourizing units, producing more usable heat for every litre of waste oil burnt. Because waste oil is basically a free commodity, furnace efficiency is not considered vital to a successful installation, receiving a weighting of 2.

5.2 Calculations

Evaluation \ Criteria	CAPITAL COST	O&M COST	EASE OF OPERATION	CONTROLABILITY	RELIABILITY	EMISSIONS	EFFICIENCY	WEIGHTED TOTAL	
	2	3	3	2	3	4	2		
Atomizing									
BG150XL	2	4	4	5	2	1	5	58	
BG200	2	4	4	5	2	1	5	58	
CB-86-AA	1	3	4	4	2	1	5	51	
CB-86-AH	2	3	4	5	2	1	5	55	
CB-86-BH	2	3	4	5	2	1	5	55	
RA/230	3	3	4	4	2	1	5	55	
RAD 230	3	3	4	5	2	1	5	57	
RA 118	1	3	4	4	2	1	5	51	
RAD 118	1	3	4	5	2	1	5	53	
CA-200C	1	3	4	4	2	1	5	51	
CA-110	1	3	4	4	2	1	5	51	
CD-150	1	3	4	5	2	1	5	53	
MF-150	1	3	4	5	1	1	5	50	
FLA 175	1	3	4	4	2	1	5	51	
FLA 350	3	3	4	5	2	1	5	57	
FLA 495	3	3	4	5	2	1	5	57	
Vapourizing									
Advanced 250	5	2	2	3	4	4	3	62	
CTB-87	5	1	1	3	5	4	3	59	
HT-87	5	1	2	3	4	4	3	59	
LV-110	1	2	2	1	5	4	3	53	
L220-E	2	2	2	1	5	4	3	55	
W400VL	3	3	3	3	5	4	3	67	
K410	5	3	3	3	5	4	3	71	

Weighted Total = Sums of (Criteria x Evaluation)

Evaluation:

- 1 - Poor
- 2 -
- 3 - Good
- 4 -
- 5 - Excellent

The weighted scores in the last column of the previous chart indicate that the two Black Gold heaters are the best of the atomizing furnaces and Kroll is the best of the vapourizing pot heaters.

The integral air compressor, standard on Black Gold furnaces, eliminates the need to run a large shop compressor during unoccupied hours and was the feature that gave these furnaces a slightly better evaluation than other atomizing units.

The Kroll K410 is partially assembled in Canada, and has a switch to alternate the burner between high and low fire. These features give this particular heater a low capital cost plus good controllability.

The various furnaces have many similar operating characteristics so the differences in the total scores are not great. Out of a total possible maximum score of 95 in this exercise, no particular model was outstanding.

The chart also illustrates the fact that the product information on most of the waste oil heaters is limited. Emissions, for example, are difficult to evaluate with any certainty. Although we were able to differentiate between pollutants emitted by atomizing furnaces and those emitted by vapourizing furnaces, ranking the atomizing furnaces amongst themselves was not possible. "Efficiency" and "Ease of Operation" were, similarly, difficult to evaluate. Still, the chart does aid in systematically choosing between the many similar products. Furthermore, the process of the value-engineering study forces one to decide on a set of evaluation criteria and to rank those criteria in order of importance with respect to their particular needs and wants.

It is very easy to adapt this exercise to changing requirements. For example, if size and weight become an important criteria when considering transporting a unit to a remote location, this could be added into the evaluation and possibly change the outcome of the results. Likewise, changing the relative weight of an individual criterion could also change the outcome of the results. If, for example, remote spaces must be heated with ductwork from the furnace, this might be considered part of controllability and increase its relative importance. Some unit heaters and space heaters would obviously score a zero evaluation in this category if they were included in an evaluation under these conditions.

6. CONCLUSIONS AND RECOMMENDATIONS

At the outset of this study, the primary objective seemed to be to determine the feasibility of waste oil burning appliances in terms of their emissions and their economics.

The evidence presented in this report clearly demonstrates that burning waste oil in furnaces specifically designed for that purpose is an economical alternative for disposing of waste oil. The payback on the total capital investment required for a typical installation will be under five years.

To address the question of feasibility in terms of emissions, one may cite a recent EPA Used Oil Final Rule (1985) encouraging people to recycle used oil by burning it on site to heat their buildings. Apparently, the EPA has decided that the environmental risk of raw waste oil far exceeds the risk due to contaminants released to the atmosphere during combustion in approved waste oil appliances. Producers of waste oil in the United States are seeking to reduce their liability due to waste oil disposal by burning it at its source.

Clearly, the feasibility of waste oil furnaces has been established in terms of both emissions and economics. Having also identified a concern for the waste oil disposal methods available to remote communities in the Northwest Territories, it is appropriate, now, to characterize the typical waste oil burning appliance installation in the Territory. Characteristics of such an installation include the following:

1. The appliance will likely be installed in the large shop, warehouse, etc. of a remote arctic community.
2. Replacement parts and qualified service personnel will not be readily available.
3. Waste oil will be collected from other sources within the community.
4. The waste oil being burned will likely be contaminated with water, antifreeze, and solvents.

It is with these points in mind that the decision as to the most suitable equipment should be made. That waste oil will likely be collected from a variety of sources within the community, alludes to a lack of quality control over the oil. As stated in some of the case studies in Appendix "B", much more care is taken in collecting, storing and separating waste oil when it is to be burned on site. Oil collected from other sources tends to contain much higher concentrations of undesirable contaminants such as water, glycol and a variety of suspended solids, adversely affecting the performance and reliability of combustion appliances. In fact, one atomizing furnace owner (Case Study No. 1) stopped soliciting waste oil from other service stations to avoid the operational difficulties encountered when burning excessively contaminated oil. Although water and glycol contamination can be dealt with quite easily by providing a drain on the bottom of the oil storage tank(s) (water is heavier than oil), suspended solids from dirty storage drums or careless collection can plug filters very quickly. Our experience has also indicated that vapourizing pot burners are far less affected by these contaminants. Therefore, where collection from other sources will provide a significant proportion of the waste oil to be burned, or where a qualified burner mechanic will not be available, our recommendation is to opt for the vapourizing pot burner type of appliance.

Having said that, another important point should be made. If the installation of a waste oil furnace is to be a success, the users of the furnace must be made fully aware at the outset that the unit is going to require far more maintenance than a conventional oil-fired furnace. The users, already aware of the maintenance involved, must also be convinced that they are the ones who are going to determine the installation´s success or failure. To be sure, improper or inadequate maintenance will result in the appliance being severely under utilized. If the potential users are apprehensive about the daily clean-out requirements of the vapourizing heaters, obviously the atomizing furnaces must be considered.

Once the selection of the unit has been made, there are a number of installation details, not mentioned in the manufacturer´s literature, that will go a long way to ensuring that the furnace operates smoothly. The oil supply system should be modified to reduce the frequency of required filter changes and the furnace (atomizing only) should not be oversized to keep from cycling on and off frequently.

Firstly, the fuel supply system must include a day tank inside the building to allow the oil to warm to room temperature prior to passing through the filters. The warm oil is much less viscous than cold oil, allowing the filters to trap only suspended solid contaminants instead of oil particles. Filters will go much longer between changes. Another modification intended to extend filter life is to install a float switch or other flow control device to control the transfer of oil to the small tank attached to some furnaces.

Many furnaces are installed in a manner that allows the oil transfer pump to run continuously, supplying more oil to the small tank than necessary. The excess oil gravity feeds back to the day tank, continuously recirculating through the filters. One further note about the oil supply is that filters should be located where they are easily changed. One installation we observed had the filters mounted directly over the oil collection tank. When the filter was removed, oil simply dripped into the tank until a new filter was attached. As a result, filter changes were quick and easy, leaving no mess to clean up.

The second installation detail to consider is the frequency at which the burner will cycle on and off during normal operating conditions. Experience has indicated that frequent burner cycling results in the accumulation of soot and creosote in both the heat exchanger and the chimney. One way to reduce this build up is to size the furnace a little on the small side. The waste oil furnace may not be able to meet peak heating demands on its own, but will operate more efficiently, with less soot and creosote build up, during other times. Another way to reduce burner cycling is to ensure an unobstructed path for the return air to the furnace. Often, in dirty garage environments, air filters in the return duct clog up quickly restricting the air flow to the furnace. Thus, the air in the supply plenum tends to overheat causing the furnace to cut out on the high temperature limit. Increasing the filter area and using washable type filters (which should be washed regularly) will ensure proper return air flow to the furnace.

Because of the potential for operational difficulties, it is not recommended to use waste oil heaters as the sole source of heat. If a back-up or alternate heat source is available, undersizing the waste oil heater will not present heating problems in cold weather.

Waste oil furnaces are best suited for repair garages and storage type buildings or plants where some odour may not be objectionable. Location within the community is not critical, although they should be located near the fuel source and where used oil containers, storage tanks, etc. will not be considered a nuisance. In two of the case studies, the units are located in the heart of downtown Whitehorse and have not presented any problems for nearby occupancies, including residences. Although properly burning furnaces operate without any noticeable smell or smoke, the hot waste oil used as fuel has its own characteristic odour that some might find objectionable. Proper housekeeping and fuel storage will keep this smell to a minimum. In a repair garage environment, this smell is not noticed.

Summarizing, with the cost of heating oil rising and environmental concerns growing, waste oil burning appliances are becoming increasingly attractive. It must be understood, however, that waste oil furnaces require more maintenance than conventional furnaces. Implementing a regular maintenance program will make or break an installation. This comprehensive list of available products, together with practical installation suggestions, should provide a valuable guide to anyone interested in investigating further the option of using waste oil furnaces in the Northwest Territories.

7. ACKNOWLEDGEMENTS

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4. "Comparison of Air Pollutant Emissions from Vapourizing and Air Atomizing Waste Oil Heaters", by Robert E. Hall, U.S. Environmental Protection Agency Research, Triangle Park, North Carolina, and W. Marcus Cooke and Rachael L. Barbour, Batte Columbus Laboratories, Columbus, Ohio, March 1985.

APPENDIX "A"

Case Studies

CASE STUDY NUMBER ONE

Location:

Whitehorse Motors, Whitehorse, Yukon
Unit installed January, 1986

Technical Data:

Sunfire Model CBWO-11-AC heater rated at 205,000 Btuh, with a 1.8 USGPH atomizing type burner nozzle, operating at an oil pressure of 6 psi and an air pressure of 8 psi.

Description:

The waste oil heater provides heating for both a 5,000 ft.^{2} automotive shop with several large overhead doors at each end and an adjacent 2,000 ft.^{2} body shop. Located on a metal superstructure overhead in the automotive shop, the unit is ducted to provide air to both shops.

Waste crankcase oil is poured through a screen into a small collection tank from where it is pumped to a 3,000-gallon buried storage tank outside the building.

As required, oil is pumped to a 250-gallon day tank inside the shop using a reciprocating air pump with an air to fuel piston ratio of 3:1. Oil is then pumped to a 6-gallon tank attached to the furnace. Originally, a conventional furnace pump was used for this purpose but failed after only three months of operation. A special pump designed specifically for pumping waste oil was installed and has provided trouble-free operation ever since. The 6-gallon tank has a submersed electric coil that preheats the oil to 100°F prior to entering the burner.

The majority of the waste oil burned at Whitehorse Motors is generated internally through their service operation; the remainder of the oil is solicited from other service stations in town and from Yukon Electrical. As a result, the waste oil burned is primarily automotive crankcase oil with some diesel and aviation crankcase oil and small amounts of miscellaneous gear and transmission oils. Two in-line filters remove suspended solids from the oil prior to entering the small tank on the furnace. Water and sludge are allowed to settle out in the day tank; water is drained from the bottom of the tank every few days. No additional oil pre-treatment is carried out.

Financial Analysis:

The original capital investment for the furnace, initial duct work, 250-gallon day tank and the supporting superstructure totalled about $20,000. In January, 1987, a 3,000-gallon buried tank, a screened collection tub, additional duct work, and miscellaneous modifications were added which have now increased the capital investment to about $28,000.

Maintenance on the unit entails changing the two in-line filters once a week ($12 each). The fire box of the unit is cleaned every two months during the heating season and the burner nozzle is cleaned every three months. Once a year, water and sludge are purged from the large buried tank.

It is estimated that about 4,500 gallons of waste oil are burned in the furnace each year, displacing approximately $7,000 worth of heating oil annually.

Payback Summary:

		$/Year
Annual Revenue	- 4500 gallons heating oil @ $.35/L	$7,000
Annual Costs*	- 2 filters per week	728
	- 5 min. per week changing filters	40
	- 30 min. every 2 months cleaning fire box	26
	- 30 min. every 3 months cleaning nozzle	18
	- 5 hr. every year cleaning tank	75
	Total costs	887

* - labour cost assumed @ $15/hr
  - heating season - 7 months

Overall Savings	$6,113
Capital Cost	$30,000

Therefore, Simple Payback = about 5 years.

Comments:

Although the analysis indicates a five-year payback, the capital costs for all of the system components, including the buried fuel tank, were included. The payback on the furnace itself ($14,000) would be closer to two years.

CASE STUDY NUMBER TWO

Location:

Mic Mac Motors, Whitehorse, Yukon
Unit installed Fall, 1985

Technical Data:

Lanair Model L-220-E heater rated at 160,000 Btuh with a 1.14 USGPH vapourizing nozzle.

Description:

The waste oil heater is installed in an old, energy-inefficient automotive garage with two large overhead doors at one end.

Waste oil is collected in a 250-gallon tank with a course screen to filter suspended solids. Every few days, the oil is pumped to a suspended 60-gallon tank which gravity feeds to an 8-gallon tank on the waste oil heater.

All the waste oil burned at Mic Mac Motors is generated on site. Waste oil used to be solicited from other sources but the oil tended to be excessively contaminated and caused enough problems with the heater to make the practice unworkable. The waste oil burned contains automotive and diesel crankcase oil, as well as significant quantities of transmission fluid, differential oil and small amounts of cleaning solvents. Filtering the oil in two fine screen filters located on the 250-gallon tank and the 8-gallon tank respectively is the only oil pretreatment process performed prior to combustion.

Financial Analysis:

In addition to the heater, the initial installation included a 250-gallon day tank, a 60-gallon suspended tank and a support structure for the furnace. The total capital investment was about $8,000. The owner of the garage estimated his savings at about $4,000 per year using the waste oil heater.

Maintenance on the unit entails cleaning the vapourizer pot every 24 hours. This task is apparently very easy to perform, requiring about 15 minutes a day. Additional maintenance must be performed on a monthly basis. The fuel tank strainer basket must be rinsed and the fuel side of the heat exchanger cleaned. The heat exchanger, combustion chamber and diffuser ring must be cleaned on a yearly basis. At the same time, the fuel pump and the chimney should be checked for fouling.

Payback Summary:

		$/Year
Annual Revenue	- 2,500 gallons of heating oil @ $.35/L	$4,000
Annual Costs*	- daily vapourizer pot cleaning (15 min.)	798
	- monthly cleaning (1 hr.)	105
	- yearly cleaning (8 hr.)	120
		1,023

* - labour cost assumed @ $15/hr.
- 7-month heating season assumed

Annual Savings	$2,977
Capital Cost	$8,000

Therefore, Simple Payback = 2-1/2 years

Comments:

The owner has indicated that the unit has not experienced a single serious operational problem in almost three heating seasons. However, the unit is not able to modulate the heat output. During weather warmer than about 0°C, the garage tends to overheat and requires the staff to use exhaust fans and the overhead doors to moderate the temperature inside the shop.

CASE STUDY NUMBER THREE

Location:

Yukon Highways Central Workshop, Whitehorse, Yukon
Unit installed Fall, 1985.

Technical Data:

Sunfire Model CBWO-11-AC heater rated at 205,000 Btuh with a 1.8 USGPH atomizing type burner nozzle operating at an oil pressure of 10 psi and an air pressure of 12 psi.

Description:

Located in the automotive repair shop, the waste oil heater provides supplementary heat to a 6,000 sq. ft. work area with overhead doors at one end.

The screened collection tank for the waste oil is located outside the building with direct gravity feed to two 250-gallon storage tanks inside the building. The oil is pumped from these tanks, through two in-line filters to a six-gallon tank attached to the furnace where the oil is preheated to 100°F. The pump is connected to the burner motor so that it is on whenever the burner is on. The pump has a capacity almost four times greater than the burner capacity resulting in a very significant amount of oil having to return to the large tanks via an overflow pipe on the six-gallon tank. As a result, the in-line oil filters filter far more oil than is required for the burner, clogging the filters prematurely. By installing a float switch in the six-gallon tank to regulate the oil level, the time between filter changes may be extended.

The waste oil at the Workshop is carefully segregated to avoid antifreeze and solvents from mixing with crankcase and gear oils. Thus, the waste oil is fairly free of troublesome contaminants that adversely affect the operation of the burner. Sludge and water are periodically purged from the bottom of the tank.

Financial Analysis:

The capital cost of the furnace and all the associated equipment, such as fuel tanks and pumps, totalled $25,000.

Maintenance on the unit involves changing the two in-line filters every two weeks ($12 each). Similar to the maintenance at Whitehorse Motors (Case Study No. 1), the fire box of the unit is cleaned every two months and the nozzle is cleaned every three months. Furthermore, an employee spends about ten minutes each morning checking the unit and ensuring it is operating properly.

Oil consumption figures for the unit were not available. However, it is estimated that the unit burns about 4,000 gallons of waste oil each year, displacing about $6,200 worth of heating oil.

Payback Summary:

		$/Year
Annual Revenue	- 4,000 gallons heating oil	$6,200
Annual Costs*	- new filters every 2 weeks	364
	- daily checks on the unit (10 min.)	532
	- changing filters every 2 weeks (20 min.)	80
	- cleaning fire box every two months (30 min.)	26
	- cleaning nozzle every three months (30 min.)	18
		1,020

* - labour costs assumed @ $15/hr.
  - heating season assumed - 7 mo.

Overall Savings	$5,180

Capital Costs $25,000

Therefore, simple payback is almost 5 years.

Comments:

Because this unit is only supplying a small portion of the building's heat, savings due to burning the waste oil are hard to estimate with any certainty. As a result, the actual payback may be somewhat different from the predicted five years.

CASE STUDY NUMBER FOUR

Location:

Yukon Alaska Transport, Whitehorse, Yukon

Technical Data:

Sunfire Model CBWO-11-AC heater rated at 205,000 Btuh, with a 1.8 USGPH atomizing type burner nozzle, operating at an oil pressure of 10 psi and an air pressure of 12 psi.

Description:

The waste oil heater is ducted to provide heat to a 2,300 $ft.^2$ truck wash bay with a large overhead door at each end. An additional duct also supplies supplementary heat to the main workshop area.

Floor-mounted in a utility room adjacent to the wash bay, the furnace draws oil from a 6-gallon tank attached directly to the unit. A float switch in this tank controls the flow of oil from a pressurized day tank in the room. An air pump is used to supply oil from the 3,000-gallon buried tank outside the building. Waste crankcase oil, and other waste oils, are collected in the buried tank as they are generated. Two in-line truck oil filters are used to filter contaminants prior to combustion.

All the waste oil burned at Yukon Alaska Transport is generated by their large fleet of diesel-engine road trains. As a result, the oil burned is relatively free of contaminants, such as lead, found in crankcase oil used in gasoline-powered vehicles. Water and sludge are drained from the bottom of the day tank periodically.

Financial Analysis:

The capital investment for the furnace, duct work, day tank and 3,000-gallon buried tank totalled about $25,000. To maintain the unit, both filters are changed weekly, the firebox and the burner nozzle are cleaned every two months, and the heat exchanger is cleaned once every heating season.

Payback Summary:

Unfortunately, persistent operational problems in the past have made it very difficult to estimate with any certainty the quantity of fuel burned by the furnace. Apparently, the primary problem has been the frequent clogging of the in-line filters. The installation originally did not include the day tank inside the building. Instead, cold oil from the buried tank was pumped directly through the filters to the 6-gallon holding tank attached to the unit. The cold oil was too viscous to pass through the filters, clogging them within hours of start up. The day tank now allows the oil to warm to room temperature prior to passing through the filters. Thus, the furnace operation has improved significantly.

Comments:

This case study, while not able to provide a credible payback estimate, does highlight a potential operational problem. When operating in extreme northern climates, the need for having a day tank inside the heated space becomes increasingly important.

Once the unit is operating properly, savings of about $5,000 per year are probable.

CASE STUDY NUMBER FIVE

Location:

Northern Kat Ltd., Dawson City, Yukon
Unit installed in 1985.

Technical Data:

Lanair Model L-220-E heater rated at 160,000 Btuh with a 1.14 USGPH vapourizing nozzle.

Description:

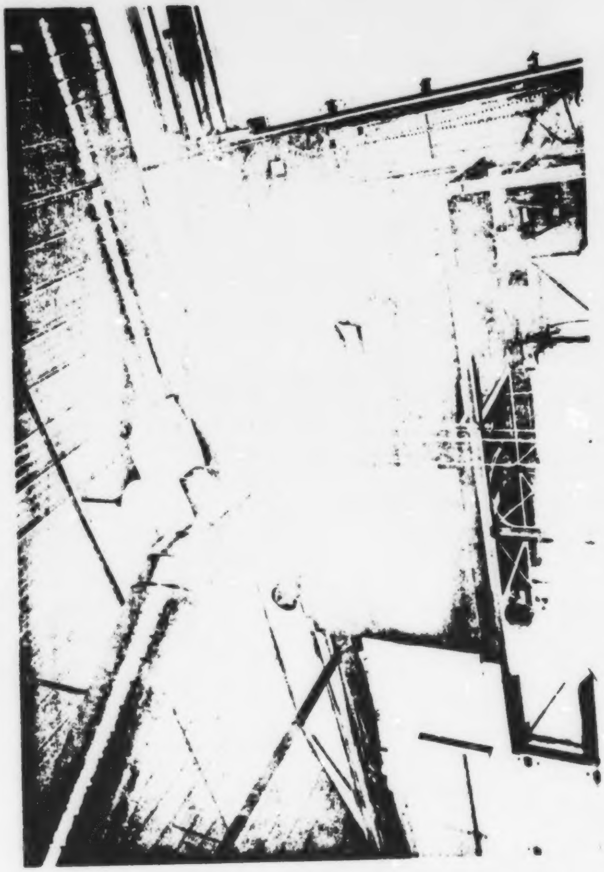
The waste oil heater is the sole source of heat for an old wood frame building approximately 30′ wide x 50′ long and 14′ high, used for heavy equipment repair. The building is not particularly energy efficient and has two large equipment doors in one end.

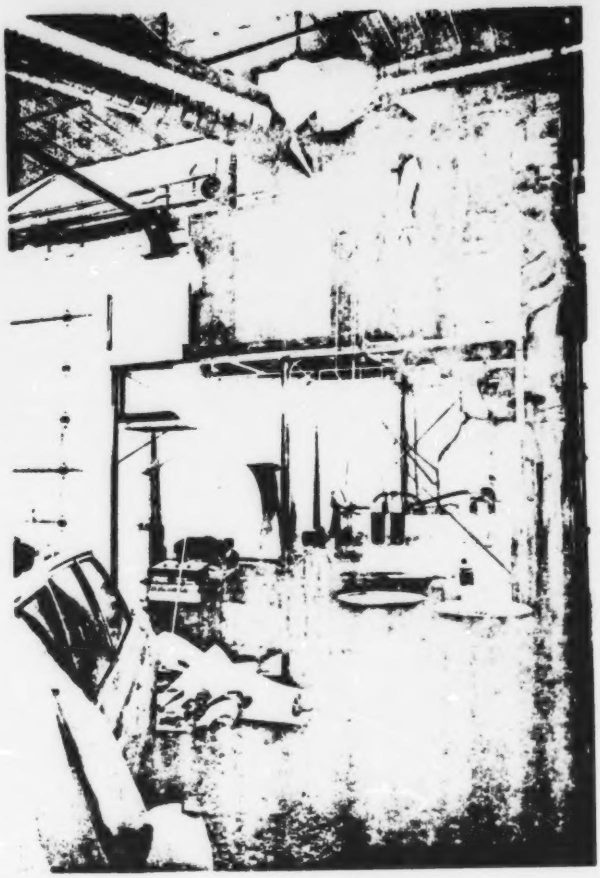
Waste oil generated on site is collected in a 250-gallon tank adjacent to the furnace. They also pick up waste oil from placer miners along the environmentally sensitive placer creeks. This oil is stored in a large outside tank. There is more oil available from this source than they are capable of burning. The waste oil used is typical of oil from heavy equipment, primarily crankcase oil with some gear oils and hydraulic oils. They do not have any specific record of the amount of oil used but estimate that they would use 3000-4000 gallons per year. The furnace tends to operate non-stop from October through April with intermittent operation in the spring and fall.

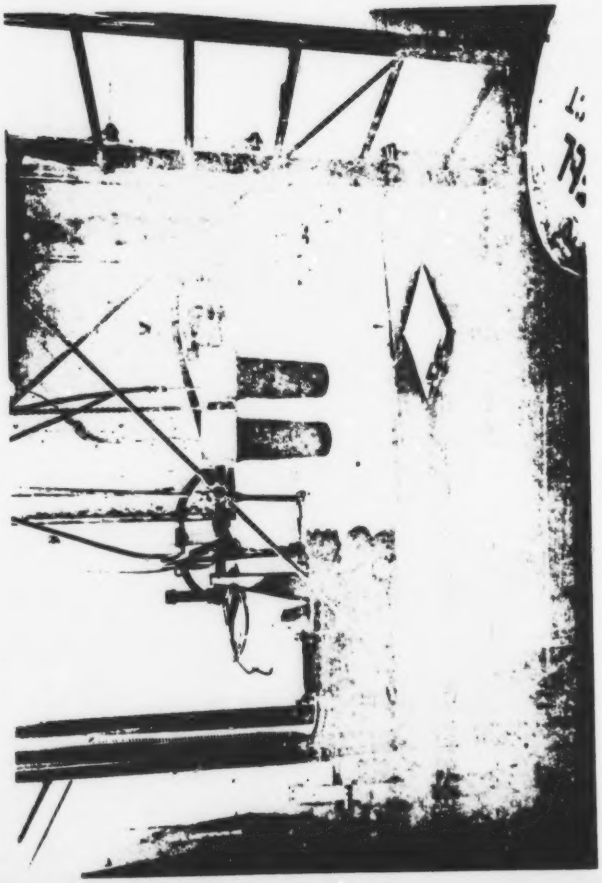
They are more than pleased with the success of this installation. The daily cleaning of the vapourizer pot is not considered a burden but it does entail someone attending to this duty on weekends and holidays. They have had to repair the gear drive for the oil injector pump and found the parts to be costly. The biggest complaint they had was about the noise generated by the warm air blower. They hope to construct a 3600 sq. ft. repair shop with office and parts storage this summer and would like to use a waste oil burning boiler.

Financial Analysis:

The owner estimates his installation cost was $7,000. He performed much of the installation work himself and did not include the cost for the tank, piping, etc. Using an average annual fuel consumption figure of 3,500 gallons and a fuel oil cost of $.42/L in Dawson City, the annual savings are estimated to be $6,709. The operator did not have a figure for the cost to collect the waste oil from the placer miners but estimates that he spends about two days a year to drive around the placer creeks picking up the waste oil with a tank carried on his truck. Assuming that he spent as much as $3,000 per year picking up waste oil and maintaining and serving his furnace, his simple payback was less than two years.



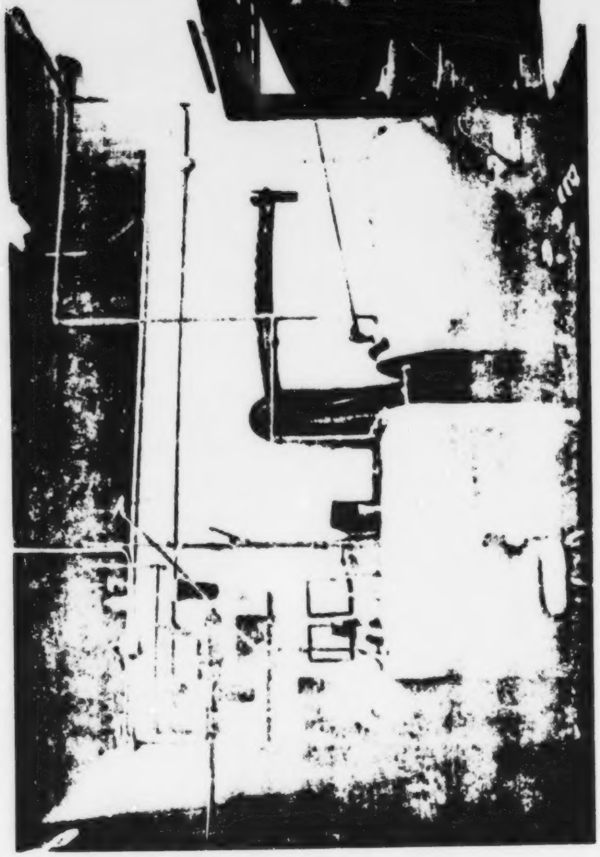


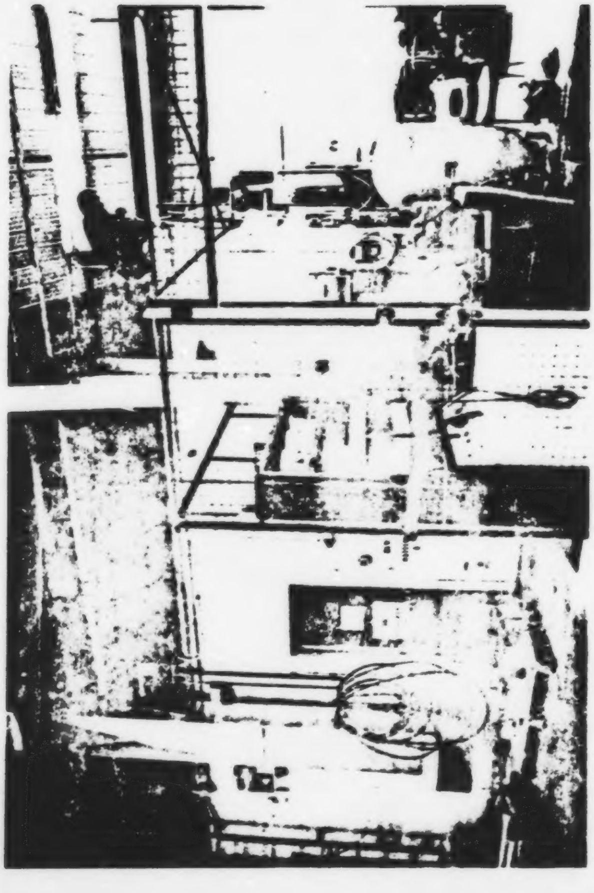


^ Whitehorse Motors,
< ^ Whitehorse, Yukon:

A clean, successful installation in its third year of operation. Good maintenance and minor modifications have all but eliminated initial operational problems.

< Note convenient set up for filter servicing.



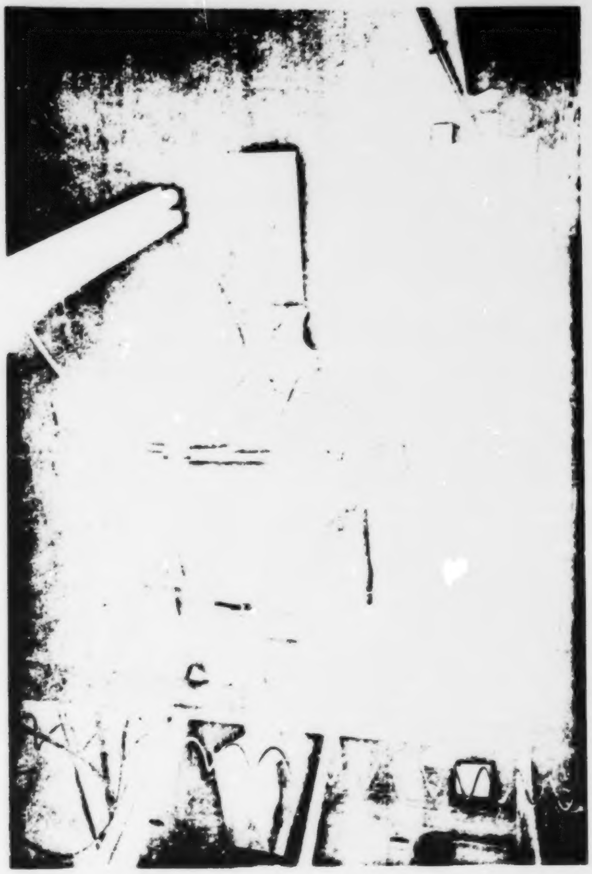


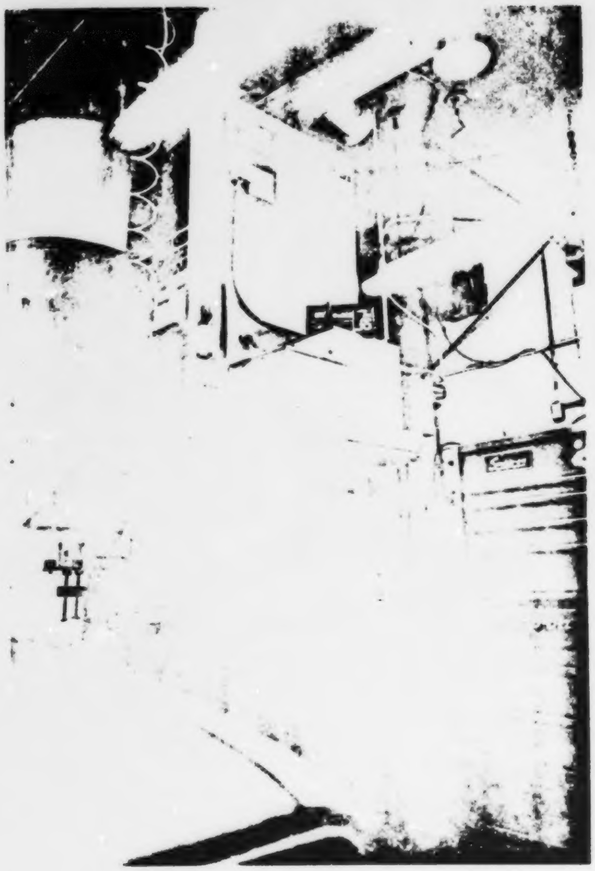
^ Yukon Alaska Transport, Whitehorse, Yukon:

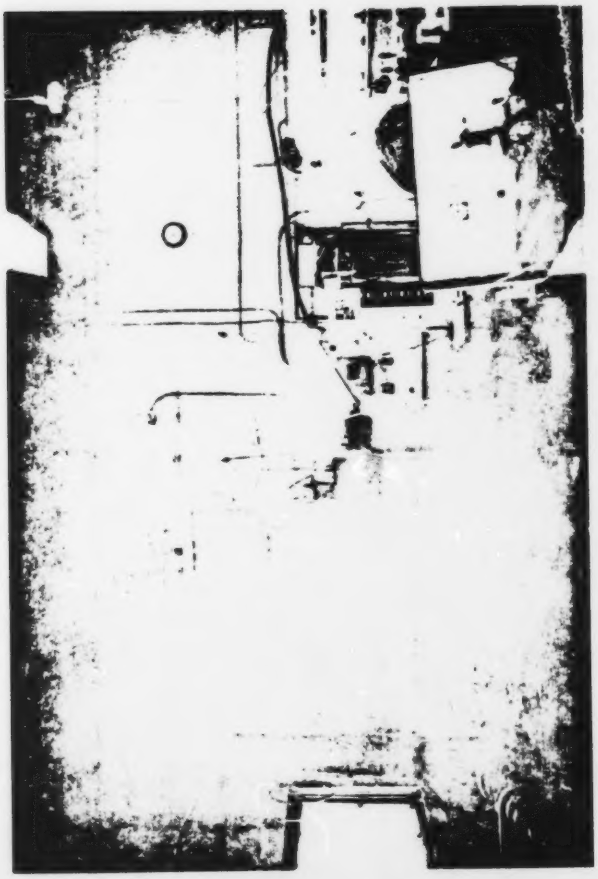
Installation errors and poor maintenance have made this 1-1/2 year old installation less than successful. The owners hope that recent improvements to the fuel supply and improved maintenance will overcome previous problems.

< ^ Gov't. of Yukon, Maintenance
< Shop, Whitehorse, Yukon:

Poor maintenance has reduced the success of this installation. This poorly-planned installation does not encourage good maintenance.







^ Mic Mac Motors,
< ^ Whitehorse, Yukon:

This 4-year-old installation has been relatively trouble free. Note ductwork and wall-mounted blower used to move heated air to other sections of the building.

< Northern Kat,
Dawson City, Yukon:

A very simple but effective installation. This 3-year-old installation is the sole source of heat for this shop.

APPENDIX "B"

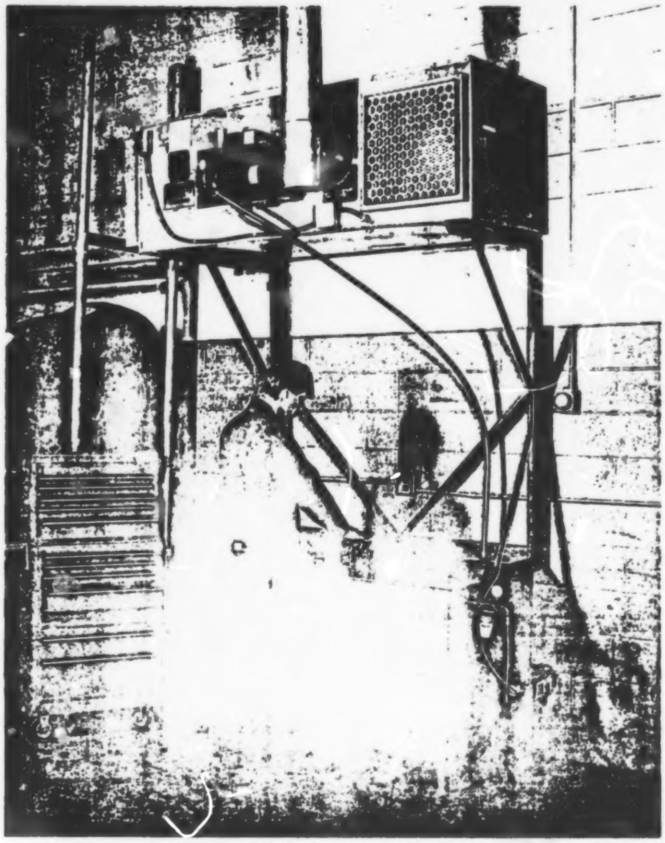
Product Literature

ATOMIZING FURNACES

BLACK GOLD INC.

Black Gold Multi-Oil Furnace System

Black Gold Workbench Tank with Stand

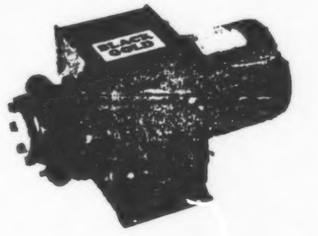


TANK SPECIFICATIONS

	LENGTH	WIDTH	HEIGHT
225 GALLON	60"	30"	30"
330 GALLON	60"	42"	30"
420 GALLON	60"	54"	30"

STANDARD FEATURES

- 4-2" THREADED FLANGES ON TOP OF TANK — 3 ALONG BACKSIDE AND 1 ALONG LEFT FRONT CORNER
- 2-2" THREADED FLANGES ON THE TOP OF EACH SIDE OF THE TANK
- 1-2" THREADED FLANGE ON THE BOTTOM OF EACH SIDE OF THE TANK
- BRACKETS TO MOUNT THE PUMP ON EITHER SIDE OF THE TANK
- 12 GAUGE CONSTRUCTION WITH 7 GAUGE TOP



BLACK GOLD TRANSFER PUMPS

- Transfers oil from outdoor storage tanks to indoor tanks.
- Available in various flow rates.
- Automatically self priming.

- The Black Gold Workbench Tank provides you with a "space saving" workbench **and** an oil storage tank.
- Use the workbench storage tank with stand (as shown) for cost saving installation and a professional appearance in your work area.
- Heavy duty construction and rust proof finish.
- Tank can be supplied without furnace stand.

MH13459
UL
UNDERWRITERS LABORATORIES INC.
LISTED
WASTE OIL BURNING APPLIANCE

Listed by the laboratories under the guide designation LWQH, Waste Oil Burning Appliances—Space Heaters and Central Furnaces.

To order, or for additional information, contact:

BLACK GOLD INC

Home Office:
124 N. Oborn • Waupaca, Wisconsin 54981
(800) 351-0643/In Wisconsin — (715) 258-6177

© Black Gold Inc. 1986

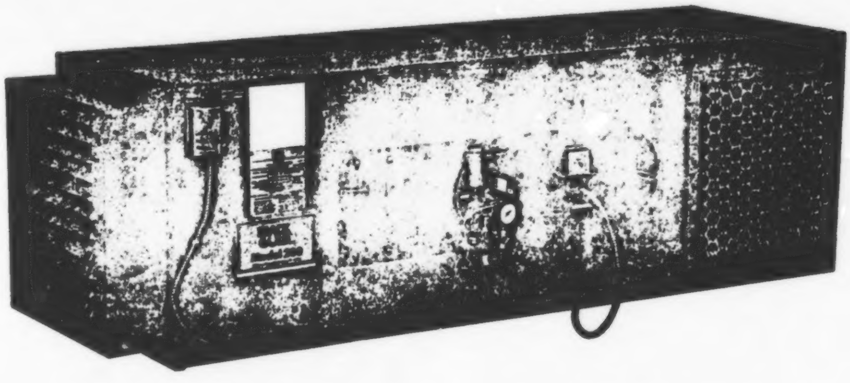
EPA and Used Oil -- see other side

BLACK GOLD® INC

EPA and Used Oil

What do you need to know to protect yourself and your business?

The Black Gold Pollution Control Furnace



Ends your liability and reduces your heating costs.

COULD MISHANDLING OF MY USED OIL BY SOMEONE ELSE AFTER THEY HAUL IT OFF COST ME MY BUSINESS?

Yes. You have probably seen the articles (for example, in *Dec. 1985 Motor)* about people acting in good faith losing their businesses from liability due to their waste hauler's mistake. Most of you are already paying your hauler for waste oil disposal and you still retain liability.

HOW CAN THAT HAPPEN?

Under federal laws and court decisions, you and your company remain liable for proper handling of your used oil, even after it leaves your business. US v. Price. (Cites to laws and cases available on request.)

You can not sign off your liability to your hauler. 42 USCA 9607 (e) (1)

The new commercial liability insurance form excludes pollution coverage. (Insurance Services Office, Feb. 1986)

Contact us for answers about used oil, heat savings or for the name of your local representative:

To order, or for additional information, contact:

BLACK GOLD® INC

124 N. Oborn
Waupaca, WI 54981
1-800-351-0643
(In Wisconsin, 1-715-258-6177)

© Black Gold Inc. 1986

NEW EPA RULE

The Nov. 29, 1985, EPA Used Oil Final Rule encourages you to recycle your used oil by burning it on-site to heat your building. 40 CFR 266.41 (b) (iii)

WHAT CAN I DO TO PROTECT MY BUSINESS AND MYSELF?

By burning your used oil in the patented Black Gold heating system, you protect your business and yourself. You quit paying someone to haul it away who you have no control over and who could cost you your business. You end your liability and reduce your heating costs.

WHY BLACK GOLD?

The Black Gold team has over 163 patents, more than 80 years of experience in building heating equipment and has brought 28 products to market successfully in the past 30 years.

The result for you is the only patented, fully automatic multi-oil furnace on the market. We have distribution, installation and service throughout the United States. Our system meets all EPA and NFPA requirements and is tested and listed for safety by ETLM and UL. The UL listing letter states, "We are pleased to acknowledge that Listing of Model BG150XL and BG200 central furnaces are the first such appliances to be Listed by the Laboratories under the Guide Designation LWQH, Waste Oil Burning Appliances."

UL
UNDERWRITERS LABORATORIES
WASTE OIL BURNING APPLIANCE

Black Gold Accessories — see other side

EPA
WASTE OIL REGULATIONS
KNOW YOUR OPTIONS

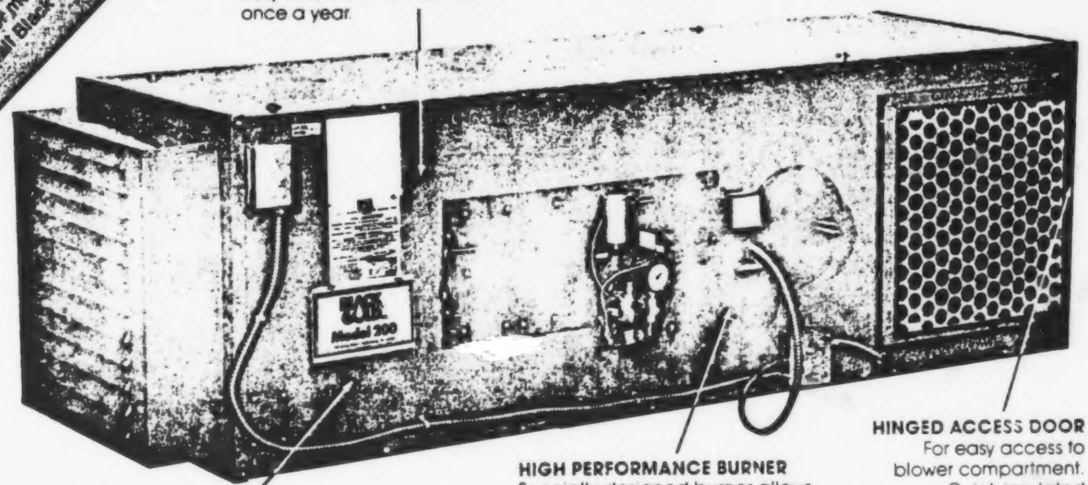
Don't risk losing your business by losing control of your waste. Even if your waste oil is mishandled by someone else after leaving you, you can be liable. Know your options under EPA Regulations and Federal court decisions. For more information contact your Black Gold representative or call Black Gold at 1-800-351-0643 (414)-644-7500

BLACK GOLD INC

Black Gold Model 200

HORIZONTAL MULTI-OIL FIRED FURNACE

DURABLE HEAT EXCHANGER
Easy clean-out. Ash removal once a year.



HINGED ACCESS DOOR
For easy access to blower compartment. Quiet, insulated cabinet reduces operating sound.

HIGH PERFORMANCE BURNER
Specially designed burner allows 85% furnace efficiency, assuring perfect blend of fuel and air. Minimal maintenance needed for years of service at rated capacity. Manufactured under contract by the R.W. Beckett Corporation.

CERAMIC COMBUSTION CHAMBER
Remains stable at 2000°F. Muffles combustion noise. Will not rust or corrode.

MH13459
UNDERWRITERS LABORATORIES INC.
UL LISTED
WASTE OIL BURNING APPLIANCE

Black Gold gives a combination of features you couldn't get before in multi-oil fired furnaces.

Black Gold furnaces:

- **burn waste crankcase and lube oils up to 50 wt. and automatic transmission fluids, as well as standard #1 and #2 heating-oils (ASTM D396).** ***And, they burn all of these oils cleanly up to 85% efficiency, making them the most efficient waste oil furnaces on the market.***
- **are UL and ETLM listed and tested to ETLM 83, UL 296 and UL 727 standards.**
- **are totally automatic, thermostatically controlled.**
- **meet all national and local fire codes.**
- **use standard furnace components.**
- **may be used as an area heater or can be ducted.**
- **require furnace cleaning once a year with minimal monthly fuel line maintenance.**
- **need no accessory systems — they come complete, ready for installation.**

With burner and furnace units specifically designed to solve the problems of burning waste oils, Black Gold furnaces are the safest, most reliable waste oil furnaces available. And, they will save you money, year after year.

Our people make the difference. The Research and Development Team that perfected the Black Gold Multi-Oil Fired Furnace collectively has a total of 80+ years of experience. They hold 128 patents and have had 22 successful new product introductions in the past 22 years. The heavy oil combustion system in the Black Gold furnaces is so unique that Black Gold is the only automatic atomizing waste-oil furnace on the market to have been awarded a U.S. Patent!

Black Gold's high performance and reliability result from three innovations. The burner produces a flame 400°F to 1000°F hotter than conventional waste oil heaters. A special air atomizing nozzle is anti-drip and self-purging. The solid-state, nozzle-mounted preheater gives fail-safe start-ups with no controls to fail.

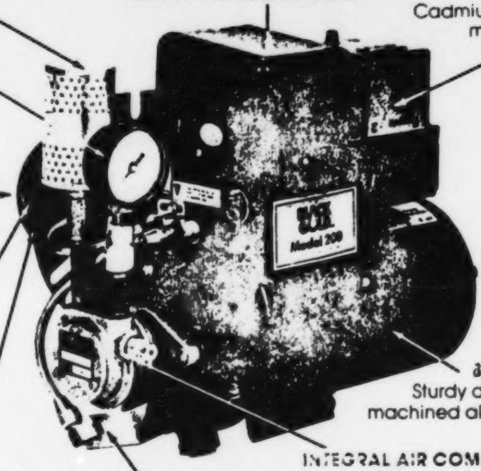
The burner's self-cleaning fuel regulator contains no floats or electrical controls to cause failure. Flame centering is automatic. Superior combustion efficiency provides smokeless, odorless operation. The transfer pump and air compressor are integral parts of the system — there's no extra pump or compressor to buy.

The furnaces are specifically designed for maximum safety without wasting valuable floor space. They can be mounted at 8' above the floor level to meet NFPA and local codes. The ceramic combustion chamber eliminates "hot spots", remains stable at temperatures over 2000°F, muffles noise and will not rust or corrode as steel units will. Slide out air filters are easily serviced from either side. Repair parts and service are readily available.

It can be used as an area heater or joined to existing duct systems in virtually any commercial or industrial installation, such as service stations, repair garages, car, truck and tractor dealerships, farm and off-highway equipment repair garages, fleet garages, railroad shops, boat repair shops, airplane hangers, and highway maintenance garages — wherever heat is needed at the lowest possible cost.

Black Gold offers a one-year limited warranty on its furnaces. In addition, technical assistance may be obtained by telephoning Black Gold's factory service department at (800) 351-0643 during the hours of 9:00 a.m. - 4:00 p.m., CST, Monday thru Friday.

Remember, every time an auto or vehicle goes up on the rack or over the pit for an oil change, Black Gold can take that gunk and turn it into real gold — savings of up to 100% on fuel costs for you, every heating season!



AIR FILTER FOR COMPRESSOR
Provides cleanest possible air to nozzle.

IGNITION CONTROL
Hinged for easy accessibility to nozzle, oil lines, electrodes.

PRIMARY CONTROL
Cadmium sulphide cell constantly monitors flame. Shuts burner down if flame is lost.

PRESSURE GAUGE
Allows quick, easy visual check to maintain proper air pressure.

FLAME RETENTION HEAD
Special stainless steel construction, automatic nozzle centering, fixed alignment. Fuels burn at higher CO$_2$ without smoke. Highly stable and intense combustion allows furnace efficiency to 85%. Intense flame handles wide variation in fuel characteristics.

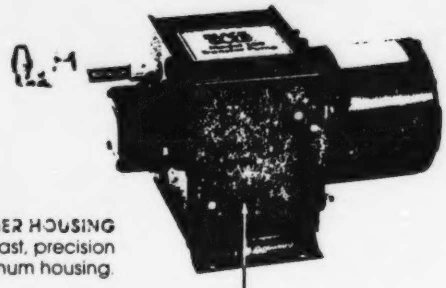
AIR ATOMIZING NOZZLE
Anti-drip, self-purging, improved fuel atomization. Variable firing rate without changing nozzle.

BURNER HOUSING
Sturdy die-cast, precision machined aluminum housing.

INTEGRAL FUEL HEATER
Self-regulated. No thermal switch required.

INTEGRAL AIR COMPRESSOR
No remote air source required.

UNIQUE FUEL REGULATOR
Self-cleaning. No moving parts or float switch to fail.



FUEL TRANSFER PUMP
Long-life, self-priming fuel transfer pump designed for used oils. No add-on pump needed.

EQUIPMENT FEATURES	OPERATING ADVANTAGES
• Automatic ignition/operation	• No manual lighting
• Super efficient combustion	• Clean out only once a year — not daily
• Thermostatically controlled	• Automatic temperature control
• Cadmium cell flame sensing	• Automatic combustion control
• Designed for mounting up to 8' above floor to meet NFPA and local codes	• Safety and no wasted space
• High limit switch	• Automatic protection against overheating
• Solid-state, nozzle mounted preheater	• Fail-safe start-ups. No thermostat controls to fail
• Self-cleaning fuel regulator	• No floats, tank or electrical controls to fail
• Self-priming fuel transfer pump included as standard equipment	• Primes automatically. No extra cost for pump.
• Special flame retention head	• Outstanding combustion efficiency without smoke. Less affected by poor draft and variations in fuel quality. Automatic flame centering.
• Special air atomizing nozzle	• Anti-drip — self-purging
• Ceramic combustion chamber	• No rust or deterioration like steel chambers
• Cleanable, reusable Triple Protection Fuel Filter System	• Minimal monthly fuel filter maintenance
• Can be used as a unit or duct heater	• Flexible installation
• Integral air compressor	• No remote air source required

BLACK GOLD SPECIFICATIONS

MODEL NUMBER	DIMENSIONS	FUEL	MAXIMUM FIRING RATE	BTU/HR INPUT	TEMP. RISE	C.F.M.	DRIVE	MOTOR HP	BLOWER SIZE	FLUE DIAMETER	FILTER SIZES	APPROX. SHIPPING WEIGHT	ELECTRICAL POWER — AC 60 HZ	POWER FUSING — AMP
BG150XL	79½" L × 26" W × 26" H	Burner designed to burn waste crankcase and lube oils, automatic transmission oils, and #1 and #2 heating oils (ASTM D396)	1.10 GPH	Up to 150,000	75°	1,575 at 0.2" WC 3,200 at Free Air	3½" × 7"	1/2	12" × 12" Squirrel Cage Fan	7"	(2) 20" × 20" × 1"	470 lbs.	115 Volts Single Phase	20
BG200			1.43 GPH	Up to 200,000		2,100 at 0.2" WC 3,600 at Free Air		3/4						

We reserve the right to amend these specifications at any time without notice.

MH13459
UNDERWRITERS LABORATORIES INC.
UL
LISTED
WASTE OIL BURNING APPLIANCE

To order or for additional information, contact:

BLACK GOLD INC

Home Office:
124 North Oborn Street • Waupaca, Wisconsin 54981
(800) 351-0643 / In Wisconsin — (715) 258-6177

Form No. 16178
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Patent No. 4,487,571
Foreign Patents Pending
Black Gold is a registered trademark of Black Gold, Inc

Listed by the laboratories under the guide designation LWQH, Waste Oil Burning Appliances—Space Heaters and Central Furnaces.

CLEAN ENERGY INC.

CLEAN BURN
MULTI-OIL FURNACE

THE . . .

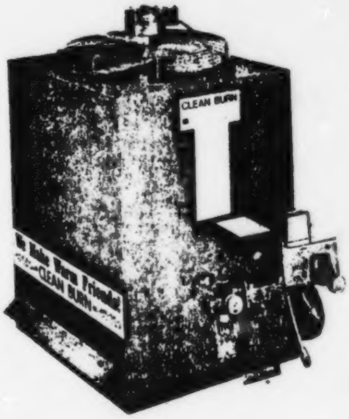
INCREDIBLY RELIABLE

**WASTE OIL FURNACE
YOU'VE HEARD ABOUT!**

WE MAKE WARM FRIENDS

Industrial-grade furnaces at affordab
specially engineered to turn waste oi

If you generate waste oil, stop paying to have it hauled away. With a Clean Burn furnace it's a source of free heat.



MODEL
CB86AA

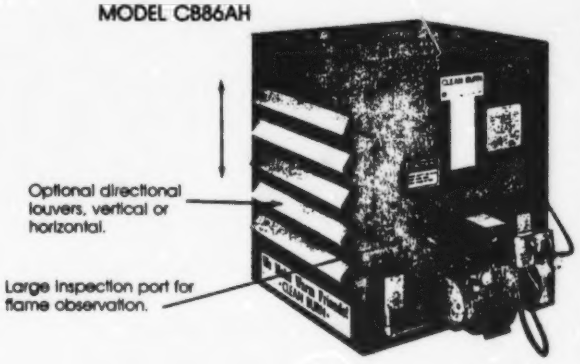
CLEAN BURN FURNACE FEATURES:

STAINLESS STEEL TARGETS. Clean Burn furnaces do not have ceramic liners, as used in most converted stock furnaces. Waste oil burns at a much higher temperature than stock oil furnaces can handle; debris in waste oil, such as colloidal metals, bombard the target in the combustion chamber. Clean Energy protects the target by distance and use of 11-gauge stainless steel. Unlike targets in converted stock furnaces, our targets are easily replaceable; further, they transfer heat more quickly than ceramic, preventing overheating of combustion chambers while maintaining high efficiency.

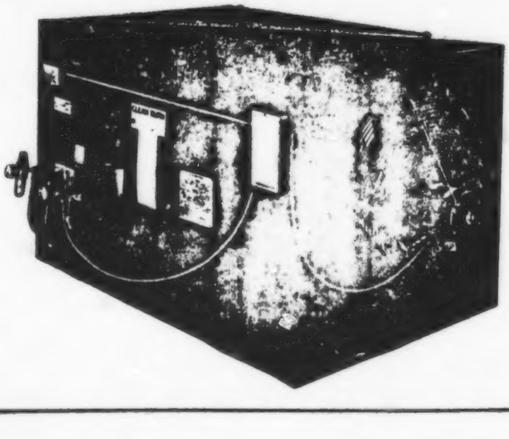
NO RETURN LINE. One oil transfer pump is all that is required to make a **Clean Burn** furnace work. Unlike others on the market which require a gravity return line, an auxiliary tank under the heater, and two pumps, **Clean Burn** furnaces use a single-line pressurized feed line system making a return line unnecessary, and reducing installation, repair, and maintenance costs. Only one tank is required for the oil supply and only one pump, thus saving valuable floor space. With the **Clean Burn** pressurized system, the filter filters only what the furnace burns, lowering filter maintenance and pump wear.

SAFETY. UL Test Standards 296, 727, 734ETLM Listed ETLM-Test Standard 83-1. **Clean Burn** furnaces are equipped with UL-listed primary safety controls with cadmium sulfide cells for flame monitoring, and UL-listed air pressure and high limit temperature controls for clean burning of fuels and immediate burner cycling if furnace reaches more than 200° F. **Clean Burn** furnaces are designed to destroy waste oil in warm, as well as cold, weather; when temperature reaches 200° F, the burner cycles on and off, unlike converted stock furnaces which remain shut down.

MODEL CB86AH

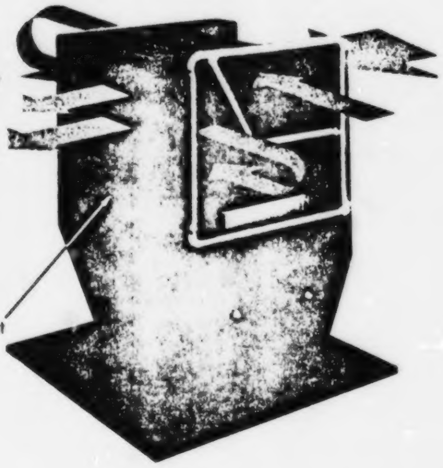

Optional directional louvers, vertical or horizontal.
Large inspection port for flame observation.

Permanent-type, washable filter.



MODEL
CB86BH

prices, into heat


Makes 3 passes for low emissions and high efficiency.
Heavy construction, made to last
Unique tube design facilitates easy efficient cleaning.

BURN A MULTITUDE OF HYDROCARBONS. Clean Burn furnaces are listed for No. 1 and No. 2 fuel oil, used crankcase oil, and transmission fluid. The adjustable rheostatic temperature control on the oil preheater allows oils of different viscosities to be burned.

FLAME RETENTION. Clean Energy's design (our own) is unique. The flame cone has adjustable blades to accommodate varying fuel spray angles caused by different types of waste oil.

LARGE INDUSTRIAL-TYPE WASTE OIL PUMP, which fulfills all oil transfer requirements. (Furnished with each furnace.)

EXCEPTIONAL EASE OF CLEANING. Daily clean-outs are not required; once or twice a year is usually enough.* **Clean Burn** furnaces are **not** converted, repainted hard-to-clean stock oil furnaces; **Clean Burn's** lift-out panels provide fast, easy access to dust chambers.

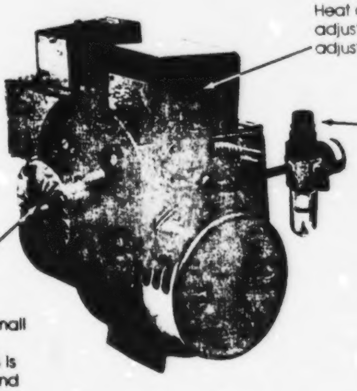
CLEAN-BURNING, without smoke or odor. The oil and air are superheated for efficient combustion. The blacker the oil, the hotter it burns; The colloidal carbon in waste oil combines with the superheated oxygen in air to form carbon dioxide.

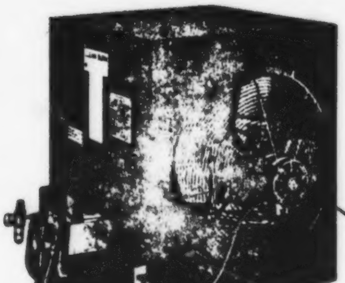
QUIET OPERATION. All moving parts are rigidly bolted onto the heavy-gauge metal cabinet, making them virtually vibration free. Heat exchangers are properly designed to allow air to flow over them smoothly and quietly.

FULLY AUTOMATIC, controlled by a wall thermostat for reliable 24-hour service.

FULL PARTS WARRANTY.

EASY INSTALLATION. Each **Clean Burn** furnace comes with a clear, detailed instruction and installation manual. But if you need additional assistance, a factory-trained technician is only a phone call away.


Heat output can be varied by adjustable regulator (very few adjustments needed).
Will start up in arctic conditions; air for atomization heated.
Nozzle-plugging minimal due to small oil capacity (less than 2 oz.), which is heated on demand by pressure system.


Circulation blowers.

CLEAN
ENERGY INC.

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*Depending on contaminants in the oil.

Specifications of the Clean Burn Furnace

MODEL	CB-86-AA	CB-86-AH	CB-86-BH
Variable Input BTU/hr.	63,000 to 94,000	84,000 to 186,000	186,000 to 280,000
Variable Output BTU/hr.	50,000 to 75,000	70,000 to 150,000	150,000 to 225,000
Stack Size	6 Inch	8 Inch	8 Inch
Furnace Dimensions	24" L x 20½" W x 29½" H	30" L x 30" W x 36" H	50" L x 37" W x 36" H
Approximate Weight	210 lbs.	375 lbs.	575 lbs.
Blower (CFM)	960	3,000	4,200
Electric Power	115V AC 60 Hz	115V AC 60 Hz	115V AC 60 Hz
Electric Draw	11 Amps	13 Amps	13 Amps
Approximate Oil Consumption	.5 to .7 gallons per hour	.6 to 1.33 gallons per hour	1.33 to 2.0 gallons per hour
Compressed Air Required	1.5 CFM @ 20 psi	2 CFM @ 20 psi	2 CFM @ 20 psi
Low Voltage Thermostat	Yes	Yes	Yes

HEAT EXCHANGER Made with eleven (11) gauge steel for long life

***DUCTING** All units have directional louvers or can be ducted.

CEILING MOUNT All heaters can be ceiling mounted.

All furnaces come standard with: Transfer pump, oil filter, moisture filter for air line, pressure regulators, barometric damper.

Because of product improvements, we reserve the right to make design changes without notice or obligation.

CLEAN
ENERGY INC.

83 S. Groffdale Road, Leola, PA 17540
Plant — 717-656-2011
Sales — 1-800-331-0183

Building Reliable Waste Oil Furnaces Since 1979

* EXCEPT CB-86-AA

WASTE OIL
INTO FREE
HEAT

The reliable solution to Rising
Heat Costs and Waste Oil Disposal

SUNFIRE

Sunfire's 'BURNER BRAIN'

creates a perfect combustion environment ...even when burning 50-weight waste oil!

Our remarkable highly efficient flame-tech, retention burner "Brain" ensures a homogeneous air-fuel mixture . . . right at the nozzle where it counts! This perfect mixture of air and oil allows for excellent combustion and makes the Sunfire furnace 85% efficient. Effective atomization of waste oil allows you even greater savings!

Remarkable Breakthrough

Most waste oil furnaces burn oil at a relatively low capacity and with frequent flame failures and flame control adjustment required. The revolutionary Sunfire waste oil furnace offers you a positive high-energy electronic ignition system that guarantees sure, reliable starts. NO STANDBY PILOT NEEDED! In addition, we also provide an advanced technology high limit control system that automatically activates to prevent unit overheating.

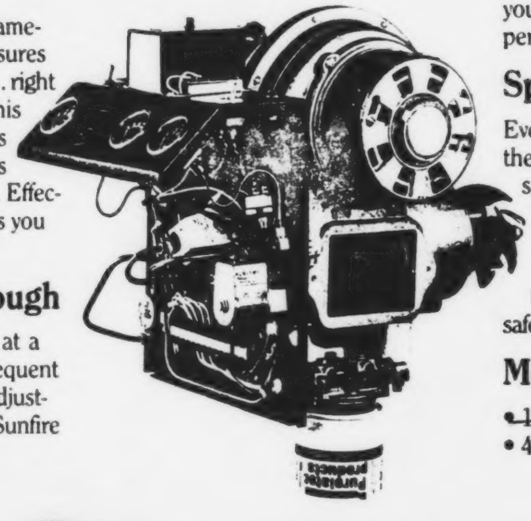


Photo Electric Sensors

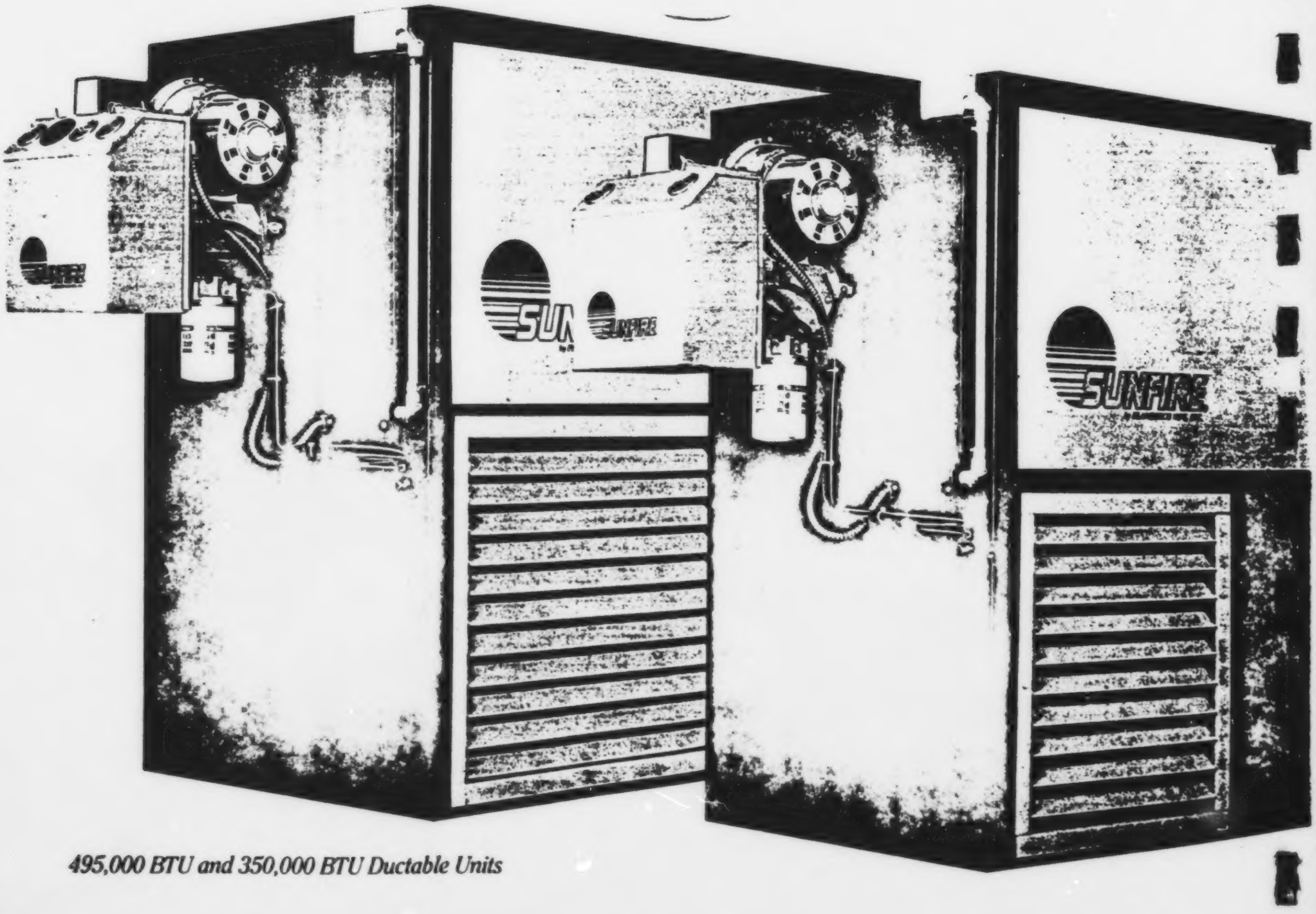
Our new photoelectric flame sensors automatically shut down the furnace if the flame fails or becomes too smoky. Our new, easy-to-reach external flame control allows for fast and convenient access to allow you to fine tune the air/fuel ratio. This enables Sunfire to provide you with easy to control combustion performance and flame stabilization.

Space-Age Control System

Every Sunfire system is equipped with the newest space-age controls to provide safe, efficient and cost-effective operation day after day . . . year after year! Our controls monitor the complete heating system including the nozzle temperature. Guaranteeing you of safe, efficient, worry-free waste-oil heating!

Models Available:

~~• 175,000 BTU~~ • 350,000 BTU
• 495,000 BTU



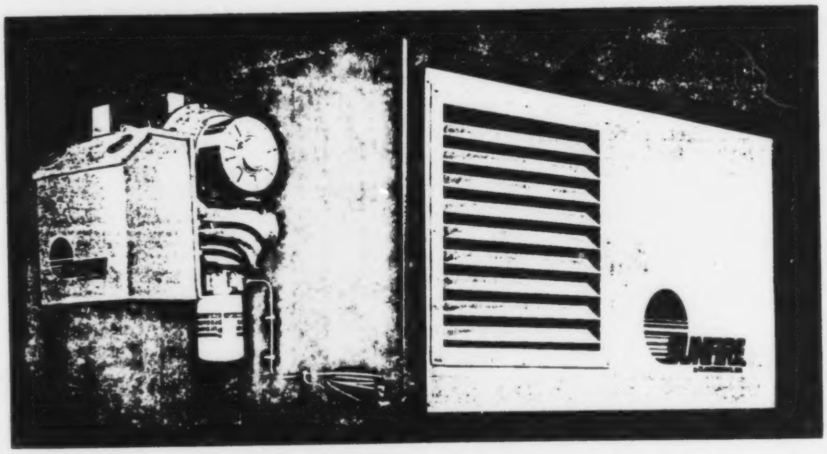
495,000 BTU and 350,000 BTU Ductable Units

Little or no service or maintenance required

Our new Sunfire waste oil heating system needs very little maintenance! The furnace needs to be cleaned only one or two times a year. A simple weekly drain check for excess water is all that is required. (Filters need changing every 30 days.) This plus our PROVEN results has made Sunfire the most talked-about waste oil heating system in North America!

Amazing filter system removes impurities...

Our filtration system has been designed to remove impurities before the oil reaches your furnace burner. The filters are contained in the system between the storage tank and the burner. These stations allow for maximum impurities removal and help maintain peak operating efficiency in your waste-oil heating system. This is another first from Sunfire . . . guaranteeing you maximum heating efficiency for the lowest dollar investment!

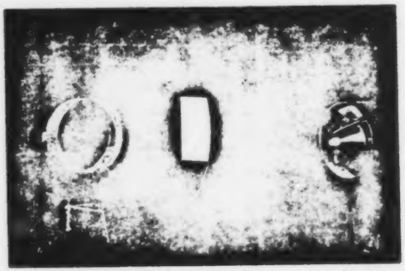


"TOTAL" heating unit provides greater efficiency!

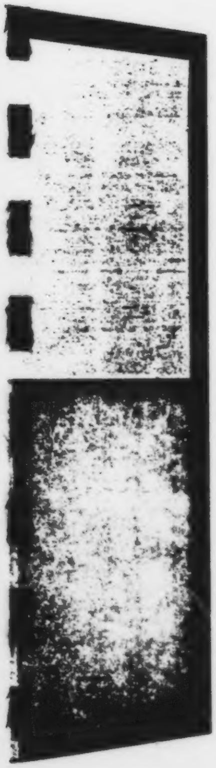
Our "total" heating system allows for the collection and storage of all waste oil products. Fast, efficient and clean disposal system frees your employees for other more profitable use of time. Never any dirty, messy waste oil to clean up.

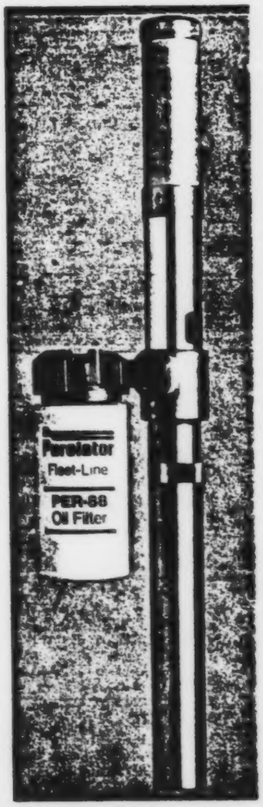
"TOTAL" heating system, storage to combustion!

The illustration above shows a "typical" Sunfire heating system. Oil is pumped from a holding tank to the furnace by a reciprocating air pump. A single oil line runs from the pump to the furnace with a check valve to ensure that oil flows only in one direction. The oil is pumped through a "cleaner" filter system on its way to the furnace for combustion. Our waste oil heating system allows for maximum combustion efficiency . . . maximum BTU's. Investigate the Sunfire waste oil heating system . . . find out how it can save you money!



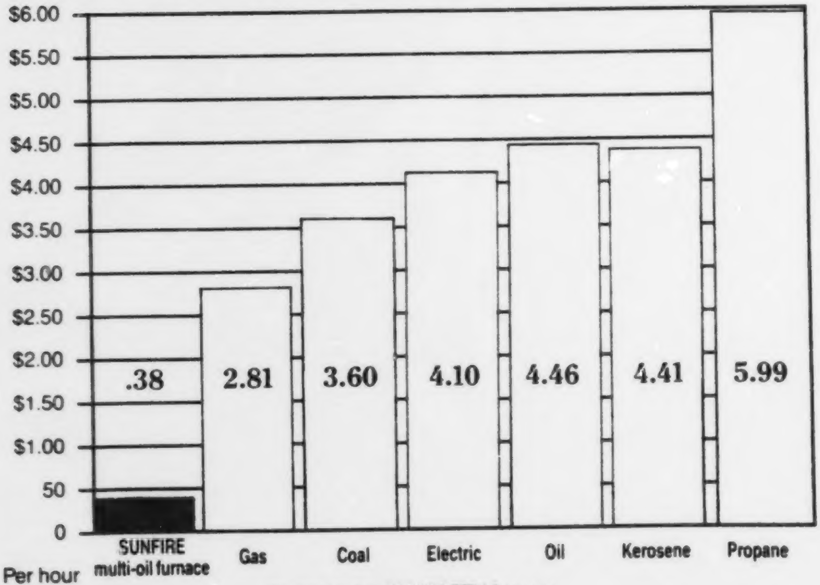
Hinged Burner for easy access to firing assembly and chamber.





Reciprocating air pump supplies oil to furnace.

FUEL COMPARISON GRAPH



*based on the 350,000 BTU furnace

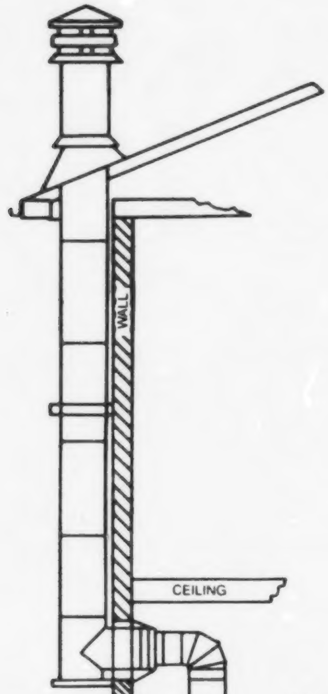
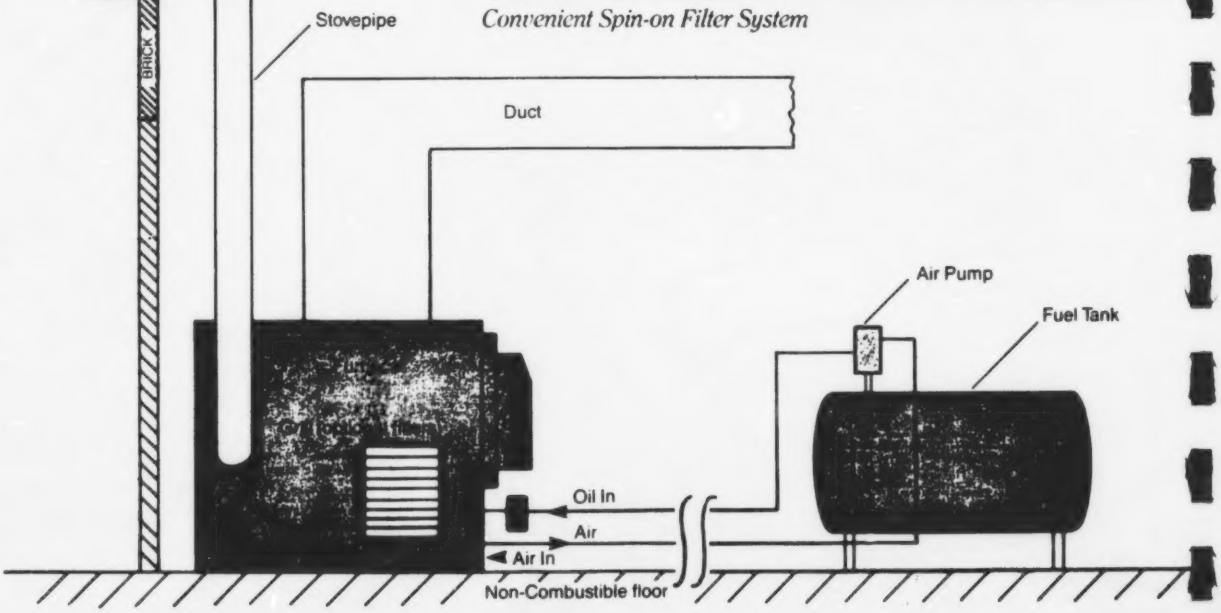
Flexible installation sites... even your ceiling is useable!

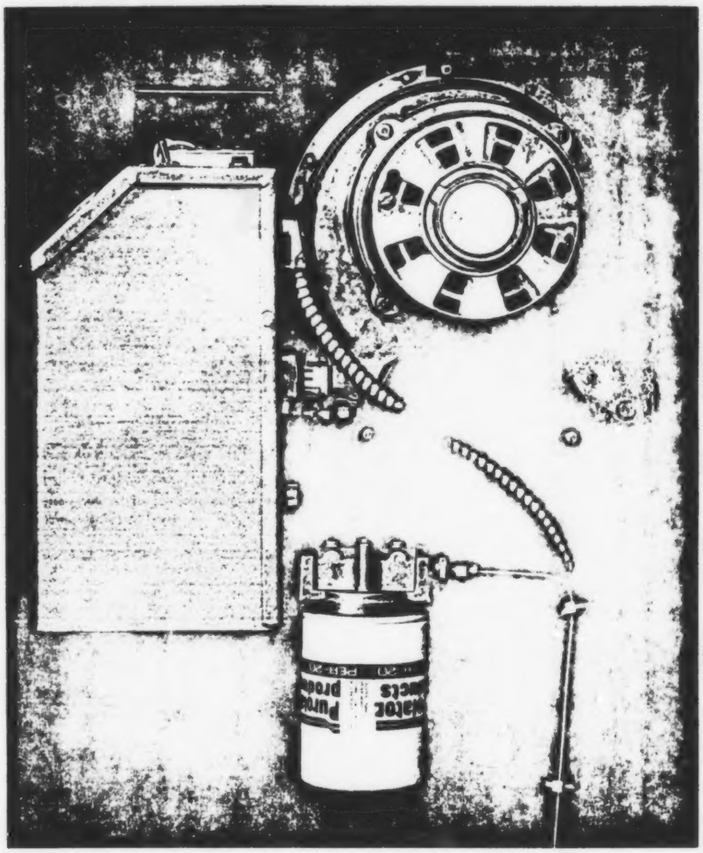
The revolutionary Sunfire waste-oil heating system is so efficient and maintenance-free that we have designed a ceiling-mount suspension unit that puts the furnace virtually on the ceiling! This allows you to save valuable floor space for profitable use.

We use standard parts in all our furnaces!

Easy to fix. That's the motto of Sunfire. Most of our components are stocked by heating/plumbing shops that are in your neighborhood. Off-the-shelf, commonly used components that are available across the country – There's more to a Sunfire furnace than meets the eye! Inexpensive, efficient and above all . . . dependable heat for the lowest possible cost.

Typical Ducted Furnace Installation



WALL
CEILING
BRICK
Stovepipe
Duct
Air Pump
Fuel Tank
Oil In
Air
Air In
Non-Combustible floor



Convenient Spin-on Filter System

Who can use the Sunfire system?

Sunfire furnaces are ideal for many different businesses where waste oil is available.

● Transmission Shops ● Automotive Repair Garages ● Truck Fleet Garages ● Railroad Shops ● Car, Truck and Tractor Dealers ● Highway Maintenance Garages ● Airplane Hangars ● Farm Equipment Repair Shops

Adding ductwork makes Sunfire one of the most versatile waste-oil furnaces made!

The new Sunfire furnace can be used as a space heater or ducts can be added to provide heat to another room or area up to 25 feet away! It will burn any oil listed on the CSA approved sheet (flame-retardant oils must be checked). All Sunfire furnaces can be installed virtually anywhere. From floor to ceiling and anywhere in between! Custom installations are our specialty. We do more than just manufacture waste oil furnaces!

Furnace Specifications

Furnace Specifications	Model FLA 175	Model FLA 350	Model FLA 495
Combustion Technique	Atomization	Atomization	Atomization
Heat Disbursement Range	175,000 BTU/hr	350,000 BTU/hr	495,000 BTU/hr
Area Heated/sq. ft.	up to 10,000 sq. ft.	10,000-15,000 sq. ft.	15,000-20,000 sq. ft.
Oil Consumption	1.2 USGPH	2.4 USGPH	3.4 USGPH
Fuel Tank Capacity	Unlimited	Unlimited	Unlimited
Electric Power	120V, 60Hz, 12.5 amps	120V, 60Hz, 21 amps	220V, 60Hz, 13 amps
Dimensions	77" × 32" × 34"	77" × 32" × 59"	100" × 32" × 59"
Weight	500 lbs.	800 lbs.	1,050 lbs.
Flue pipe	7"	10"	10"
Forced Air Blower	—	2,000 cfm	5,300 cfm

SAFETY – Sunfire furnaces are proven safe...

Our new "electronic eye" watches the flame to ensure that should the flame be extinguished a solenoid valve is immediately activated, shutting off the flow of oil to the burner. We have also incorporated a HIGH LIMIT switch that provides for fast shut-off of oil to the burner should the furnace itself overheat.

Sunfire has proven itself with more than 3,000 hours of strict laboratory testing. This, combined with our expert in-the-field service if needed and our own team of design engineers assures you of the finest product and quality control. Constructed of 14 gauge steel.

WARRANTY ON ALL MODELS

One year replacement warranty on all components and two years on the heat exchanger. No other manufacturer's warranty will apply.

- BTU rating is based on 176,000 BTU per gallon in waste oil.
- Provincial or state or local rules and regulations must be adhered to for proper installation warranty application.
- Product improvement requires that we reserve the right to change the design, rating, specifications and/or price without notice.

ALL FURNACES TO BE INSTALLED NO CLOSER THAN 36" TO ANY COMBUSTIONABLE MATERIAL.

Your authorized Sunfire Dealer:

SUNFIRE

by Flametech Mfg. Inc.
65 Union Street, Elmira, Ontario, Canada N3B 2Y3
Telephone (519) 669-5252

Printed in Canada

LENAN CORP

Designers and Manufacturers of Waste Recycling Products Introduces Another Industry First. Lanair Multi-Fueled Heating Systems:

10 YEAR LIMITED WARRANTY

We manufacture quality products, plus back them with a warranty that guarantees **zero replacement cost** during the **first five years** on the **combustion chamber/heat exchanger.** Replacement costs incured during the remaining five years of warranty are at a defined cost. Call Lenan or your Lenan representative listed below for complete warranty details. Lenan Corp. 615 North Parker Drive, Janesville, WI 53545.
Toll Free 800-356-9424, (Wis) 608-752-1601.

Note: Design and manufacturing specifications are subject to change without notice.

DISTRIBUTED BY:

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Winnipeg, Manitoba
PH: 257-4394
Box 38 Norwood Grove
Winnipeg, Manitoba R2H 3B3

MADE IN THE U.S.A.

LePC 8-87

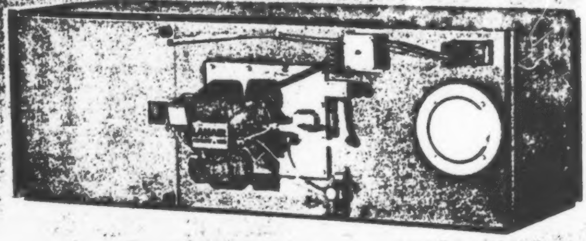
LENAN CORP

LANAIR. Recyclit™

WASTE RECYCLING PRODUCTS

CD-150

Atomization Combustion



LISTED

10 YEAR LIMITED WARRANTY

DUCTABLE
CEILING HUNG
FULLY AUTOMATIC
THERMOSTATICALLY CONTROLLED

- compatible with conventional ductwork, allowing fringe areas, perimeter offices and showrooms to benefit from inexpensive used oil heating.
- disposable return air filter.
- hi-temp, stainless steel combustion chamber and insulation.
- corrugated heat exchanger has 6600 sq. in. of prime heating surface for better heat transfer.
- forced air blower is a dynamically balanced, variable speed belt drive.
- two venting locations allow flue pipe connections to either side of unit.
- high limit control shuts unit down if temperatures exceed maximum safety levels.
- compatible with all Lenan accessories for a completely automatic, easy to use system.

Specifications:

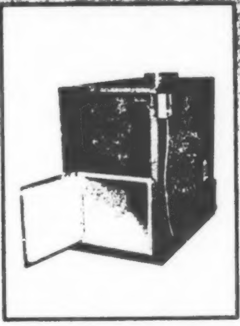
Heat Disbursement Range: (*) 150,000 Btuh
Fuel Consumption: (*) 1.07 Gph
Electric Power: 115V AC60Hz
Electric Draw: 15 Amp (max. start-up load)
Dim.: 72L × 26H × 24D (in)
Weight: 280 lbs.
Flue Pipe: 8 in ID. Class A
Forced Air Blower: 1570 CFM
Blower Drive: ⅓ hp motor
Heat Exchanger: 14 ga CR steel

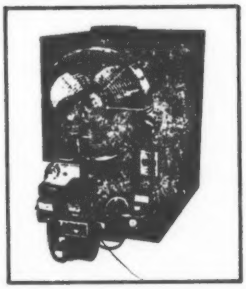
(*) burns used crankcase oil, used transmission fluid, #1 & #2 fuel oil. Btuh and consumption varies upon type of fuel burned.

CA-110

Atomization Combustion

LANAIR MULTI-OIL FUELED





10 YEAR LIMITED WARRANTY

COMPACT
FREE AIR UNIT
CEILING HUNG
FULLY AUTOMATIC
THERMOSTATICALLY CONTROLLED

- large front panel on combustion chamber is removable for easy maintenance.
- recirculating combustion chamber contains hi-temp insulation.
- tubular-flow heat exchanger extracts and delivers heat at high efficiency.
- unique baffling system in primary heat exchanger reduces exhaust velocity for a cleaner, more complete burn.
- high limit control shuts unit down if temperatures exceed maximum safety levels.
- compatible with all Lenan accessories for a completely automatic, easy to use system.
- tested and listed by P.F.S., nationally recognized testing laboratories.

Specifications:

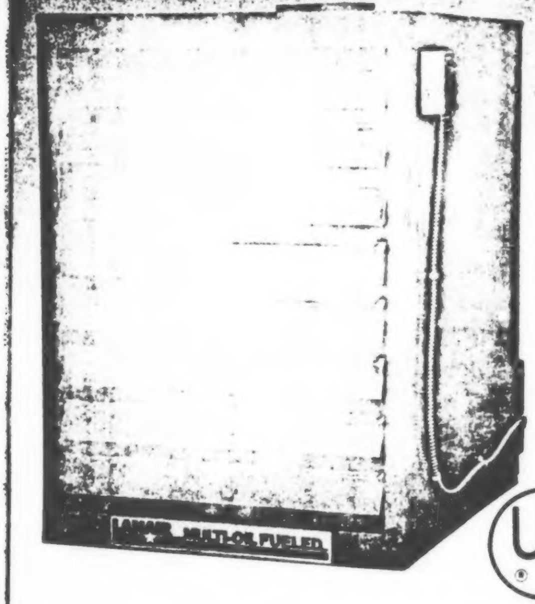
Heat Disbursement Range:(*) 100,000 Btuh
Fuel Consumption:(*) .75 Gph
Electric Power: 115V AC60Hz
Electric Draw: 13.5 Amp. (max. start-up load)
Dim.: 33H × 21W × 34D (in)
Weight: 220 lbs.
Flue Pipe: 8 in. I.D. Class "A"
Forced Air: 2,200 CFM
Combustion Blower: 150 CFM

(*) burns used crankcase oil, used transmission fluid, #1 & #2 fuel oil. Btuh and consumption varies upon type of fuel burned.

CA-200C

Atomization Combustion

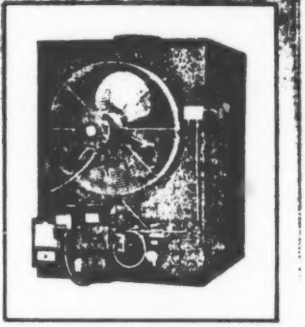
Listed By Underwriters Laboratories

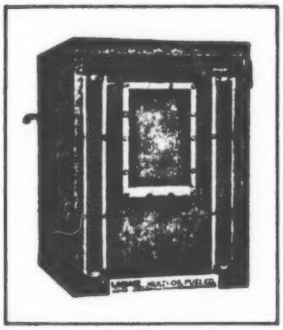


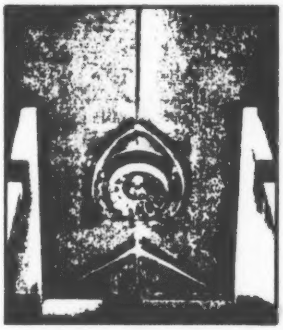
LISTED
WASTE OIL
BURNING APPLIANCE

10 YEAR LIMITED WARRANTY

HEAVY DUTY CONSTRUCTION WITH ALUMINIZED COMPONENTS ENGINEERED FOR WASTE FUELS







The CA-200 series has been on the market since 1982. The CA-200C is the first U.L. listed, free-air heating unit specifically designed and built, by an equipment manufacturer, to burn used automotive oils as primary fuel.

To our customers that means **Lenan builds Lanair products from the ground up,** using custom manufactured components, specifically engineered to burn used oil. Beware of competitive brands using retro-fit stock heating components not designed to handle waste fuels.

Being an **industry pioneer** is nothing new for Lenan. The **Lanair** product line offered the first ceiling hung **vaporization** method heating unit. The first ceiling hung **atomization** method unit was also a **Lanair**.

Being an **industry leader** is not new either, we've been doing that since 1976. Environmental and economical solutions to waste problems are our specialty.

Lanair products meet the EPA's regulation 40CFR, #266 dated 11/85; allowing the burning of on-site generated used automotive oil in used oil fired space heaters. Lanair products also meet N.F.P.A. #31 sec. 1-10 & 1-11 requirements regarding the use of crankcase oil as fuel.

HIGH OUTPUT
FREE AIR UNIT
CEILING HUNG
FULLY AUTOMATIC
THERMOSTATICALLY CONTROLLED

- recirculating combustion chamber contains hi-temp insulation.
- dual side-flow heat exchangers extract and deliver more heat than conventional designs.
- unique baffling system in primary heat exchanger reduces exhaust velocity for a cleaner, more complete burn.
- large front panels on combustion chamber and heat exchanger are removable for easy cleaning.
- high limit control shuts unit down if temperatures exceed maximum safety levels.
- compatible with all Lenan accessories for a completely automatic, easy to use system.

Specifications:

Heat Disbursement Range: (*) 200,000 Btuh

Fuel Consumption: (*) 1.25 Gph

Electric: 115V AC60Hz

Electric Draw: 14.7 Amp (max. start-up load)

Dim.: 40H x 30W x 46D (in)

Weight: 290 lbs.

Flue Pipe: 8 in I.D. Class "A"

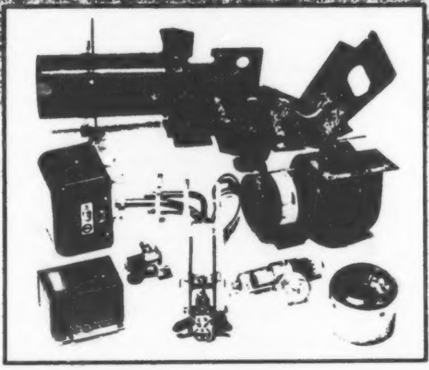
Forced Air Axial Fan: 2,800 CFM

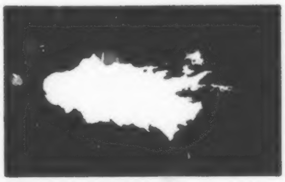
Combustion Blower: 150 CFM

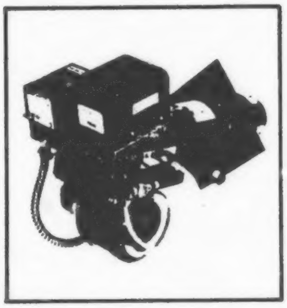
(*) burns used crankcase oil, used transmission fluid, #1 & #2 fuel oil. Btuh and consumption varies upon type of fuel burned.

2300C SERIES

Atomization Gun Assembly







HEART OF THE MULTI-OIL FUELED SYSTEM

FLAME RETENTION HEAD FOR HIGH EFFICIENCY
MODULAR COMPONENTS FOR EASY MAINTENANCE
AUTOMATIC, THERMOSTATICALLY CONTROLLED
STANDARD ON CA-200C, CD-150, CA-110 and MF-150

Operational Features:

- fuel/air preheater thermally processes fuel/air mixture for trouble free ignition.
- simplified head pressure assembly fuels preheater without electrical controls.
- atomizing nozzle breaks up fuel into micron-size particles for complete burn. (*)
- Lenan's patented turbulator flamecone design assures the cleanest burning flame in the industry.
- air operated fuel valve automatically purges nozzle prior to ignition and after shutdown. (*) This self-cleaning action maximizes unit performance.

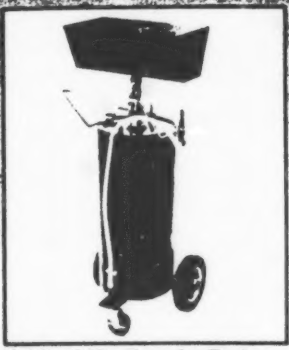
Safety Features:

- air proving switch is sensor for combustion air blower, with auto shutdown capability.
- cadmium cell monitors combustion flame, with auto shutdown capability.

Technical assistance may be obtained by calling Lenan's service department during the hours of 8:00 am to 4:00 pm. CST Monday through Friday. Call 1-800-356-9424 or 608-752-1601.

(*) requires low pressure air supply - not furnished.

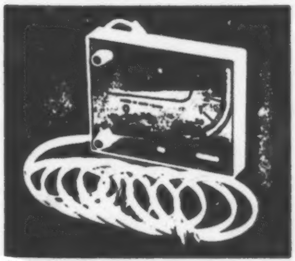
ACCESSORIES



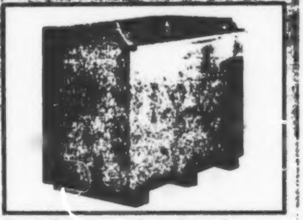
Mobile Utility Transfer Tank (MUTT)
Collects used oils from routine vehicle maintenance. Designed for air pressured discharge, unit features: 15 gallon tank; adjustable anti-splash funnel; H.D. wheels w/lock; quick connect air chuck; air gauge and regulator; relief and shutoff valves; plus discharge hose.
19"W x 20"D x 49 - 72"H

Supply Pump (*)
Delivers oil from indoor storage tank to ceiling hung unit.

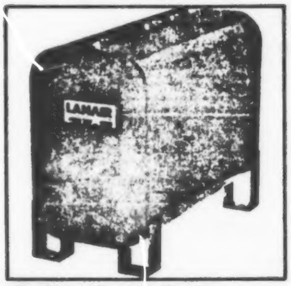
Filters (*) (not shown)
30 micron, spin on, disposable. Specifically designed for used oils.



Manometer (*)
Helps achieve maximum heating efficiency through constant read-out of flue pipe draft.



Fuel Storage/Work Bench
Combination 300 gal. indoor storage tank and work bench with 13 sq. ft. of work surface. Forged steel pipe flanges to accomodate fuel and drain lines, plus filling port. Supports Lenan's total system concept. Compatable with MUTT, fuel supply pump and all Lanair ceiling hung heaters.
60"L x 32"W x 47"H



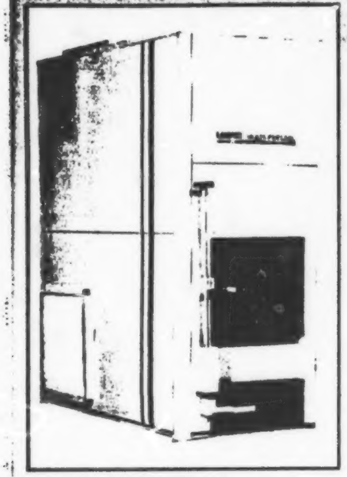
Auxiliary Supply Tank
57 gallon, indoor tank. Standard threaded pipe flanges accommodate fuel lines, fill lines and drain. Tested and listed by PFS to NFPA standards.

8" Barometric Damper (*)
Compensates for changes in atmospheric pressure.

(*) Standard equipment included in atomizing systems.

MF-150

Multi-Fueled Furnace



Burns:
Wood
Coal
Used Oil
Fuel Oil
Natural Gas
Propane

The perfect unit for solid fuel applications when there is an insufficient supply of used automotive oils as primary fuel.

The MF-150 is designed to use wood, coal, used crankcase oil and transmission fluid, fuel oil, natural gas and propane as fuel sources. This self-contained furnace is a marriage of high tech controls with traditional construction and Age-old American reliability.

- **Electronic Control Module** automatically switches from solid fuel to alternate fuels.
- **Turbo Air Afterburner's** unique design increases combustion efficiency and minimizes creosote build-up.
- **Dual Combustion Chambers.** Built of heavy gauge steel and 3000°F firebrick.
- **Lanair 2300C** combustion gun is standard equipment.
- **Tested and listed** by P.F.S., Corp.

Specifications:
Heat Disbursement Range: 150,000 Btuh(*)
Electric Power: 115V AC60Hz
Dimensions: 60H × 28W × 56D (in)
Weight: 1150 lbs.
Flue Pipe: 8 in O.D. Class "A"
Forced Air Blower: 1700 CFM
Blower Drive: 1/2 hp motor

(*) Btuh varies upon type of fuel burned. Operation with wood varies with type of wood and moisture content.

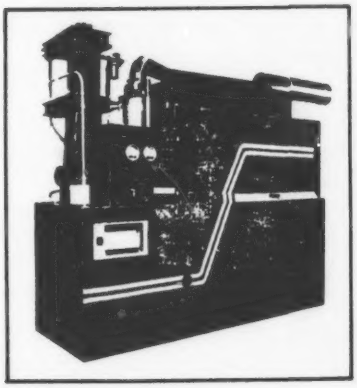
Tec Son SCRAP TIRE DISPOSAL

An affiliate company designing and marketing industrial waste recycling systems, manufactured by Lenan Corp.

Current products recycle scrap tires, rubber by-products, paint wastes and plastic scraps.

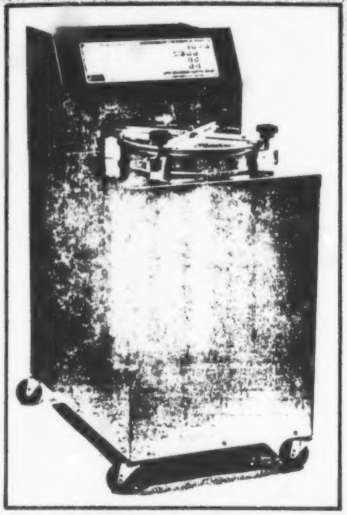
PMR 2000 module recycles 500,000 scrap tires per year.

For more information, contact TecSon toll free 800-356-9460, (Wis) 608-752-2176



R-8E

Hazardous Waste Distillation



Recyclit™

PFS PRODUCT FABRICATION SERVICE INSPECTED

HAZARDOUS WASTE PROBLEM? Here's Your On-site Solution!

Lenan Recyclit™ products are the answer to your hazardous waste disposal problems. Used paint thinners and solvents are classified as hazardous wastes . . . but, they are also **recyclable.** The EPA encourages on-site recycling and that's what Recyclit™ does for **economical** and **environmental** benefits.

It couldn't be easier to use! Simply pour in the waste and turn Recyclit on. In just a few hours, gallons of liquid waste are recycled into reusable material. No other similar product can match the R8E's combination of safety, reliability, versatility and technology.

A Lenan First, Digital Integrated Circuitry!

The R8E is the first mobile recycling unit available with:

- Fully solid state logic control, touch sensitive for unmatched safety and reliability.
- Programmable distillation ranges of 100° - 400°F, allowing for the recycling of a wider range of liquid wastes.
- Visual cycle status indicators.
- Stainless steel cabinet that's easy to clean and always looks good.
- Variable 1 to 8 gal. capacity for quick and efficient recycling of mini-loads.
- Cast 1500W heating element with aluminum wafer for more efficient heat conduction.

For a complete product brochure on Recyclit™ products, call toll free 800-356-9424, (Wis) 608-752-1601 or contact your Lenan dealer.

Turn a Waste Oil Liability Into a Comfortable Asset

EconoHeat

by

REZNOR

UL

You Are Liable

EPA Regulations make you responsible for proper handling of waste oil at your place of business and even after it has been removed. No matter who did it or how waste oil was removed, *you* are liable for it forever.

What To Do

Eliminate the problem completely with the EconoHeat unit heater by Reznor, the industry's largest manufacturer of commercial and industrial heating equipment. EconoHeat converts all your waste oil into heat, eliminates the cost and liability of disposal, and reduces overall heating costs.

How It Works

The unit uses the latest in combustion technology, atomization. The fuel (crank case oil, gear case oil, transmission fluid, brake fluid, hydraulic oil, No. 1 or No. 2 fuel oil) is preheated then atomized and sprayed into the combustion chamber where it is electronically ignited for complete burning with high heat and no smoke or odor.

Meets All Standards

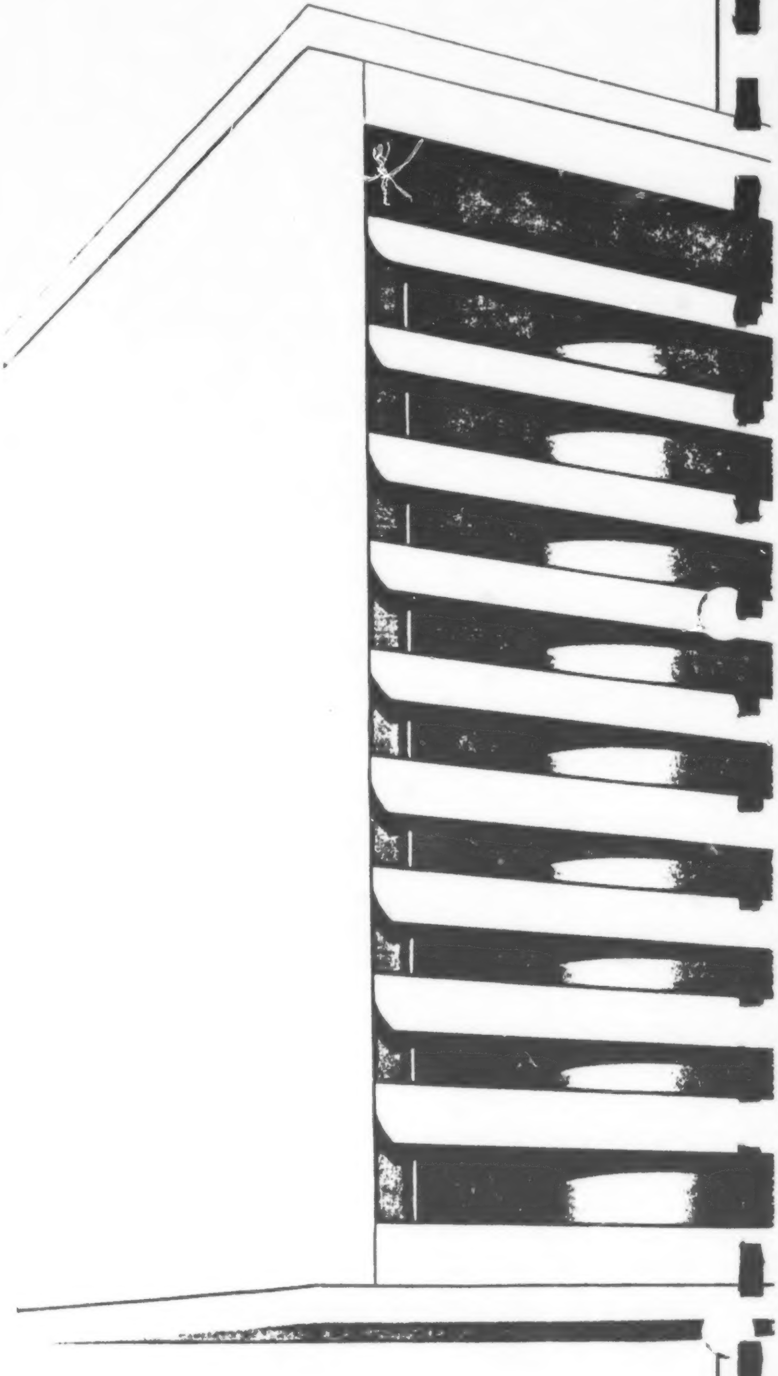
EconoHeat has been tested by Underwriters Laboratories for its designated use and is listed under MP3114. The system meets UL standards 296,731, ANSI/NFPA standard 31, and EPA 40CF.

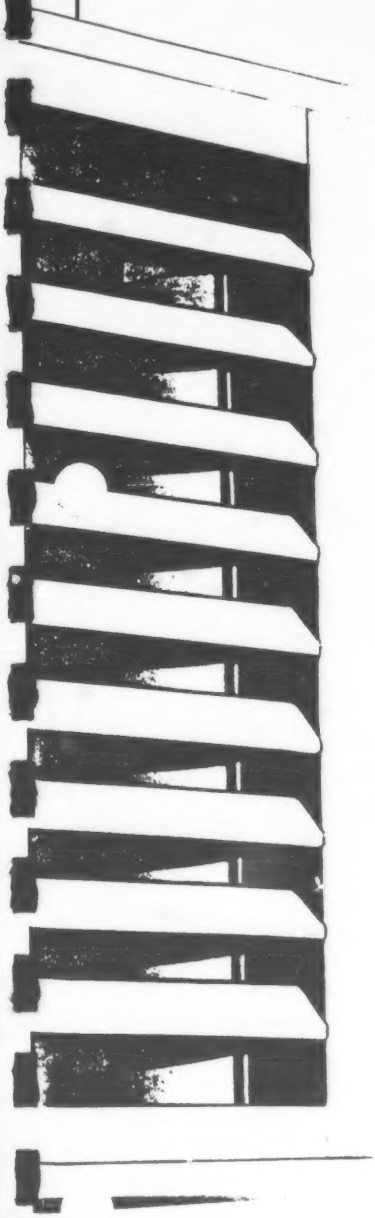
Safety Features

- Cad-cell flame safety system monitors flame light output.
- A UL combination fan and high limit control with manual fan switch is provided on each unit.
- The oil preheater has a high limit thermal sensitive safety switch.

Maintenance

Atomization provides one of the cleanest, most efficient heating systems available. Typical EconoHeat units require cleanout only once every heating season.





Payback

The amount of waste oil available and climatic conditions will directly affect the payback period of EconoHeat. However, typical installations in various parts of the country have achieved 100% payback in only one heating season.

15 APRIL

Model Series	RA/230	RAD 230*	RA118*	RAD118*
BTUs per hour INPUT	230,000	230,000	118,000	118.000
BTUs per hour OUTPUT	184,000	184,000	94,000	94,000
Nozzle Input (GPH)	1.5	1.5	.85	.85
Fan Motor (R.P.M.)	1,100	—	1,100	—
Blower Motor (R.P.M.)	—	1,750	—	1,750
Motor H.P.	1.8	1.2	1.8	1.3
AMPS Full Load 115 Volt	12	12	12	12
C.F.M. Free Air	3,000	3,000	1,600	1,600
C.F.M. 25 Ext. S.P.	—	2,140	—	1,100
Effective Air 12 Foot Suspension	50 ft.	50 ft.	40 ft.	40 ft.
Fan Dia. and Ditch	18″-36°	—	16″-30°	—
Blower Size	—	12⅝ x 12⅝	—	10⅝ x 10⅝
Flue Size	8 in.	8 in.	7 in.	7 in.
Hanger Size (I.P.S.)	3.4 in.	3.4 in.	3.4 in.	3.4 in.
Net Weight Lbs.	265	350	200	262
Shipping Weight Lbs.	325	430	250	310

3495 2895

Optional Equipment

All components for a total waste oil heating system are available from Reznor dealers. Optional components include flue kit, waste oil collector, waste oil storage tank, 225 gallon bench tank with stand, and transfer pump.

*Not available at time of printing.

What The Industry Is Saying

"We have experienced savings of approximately 30% on our heating bill. The unit is virtually trouble-free and requires little or no maintenance."

New Car Dealer, Spokane

"The EconoHeat is a very efficient heating unit. I can detect no fumes or odors from the system. I have noted no soot. The system is instant on, no wait."

Precision Tune Owner

"I want to congratulate you on getting your appliance tested by a nationally recognized testing laboratory. Other companies producing these devices have not done so and I have difficulty in approving them."

Department of Insurance,
Idaho State Fire Marshall

"Not only have the users of this equipment reduced the strict liability risk in hauling waste oil, but have reduced their heating bills tremendously."

Cottman Transmission
Systems, Inc.

ECONO HEAT

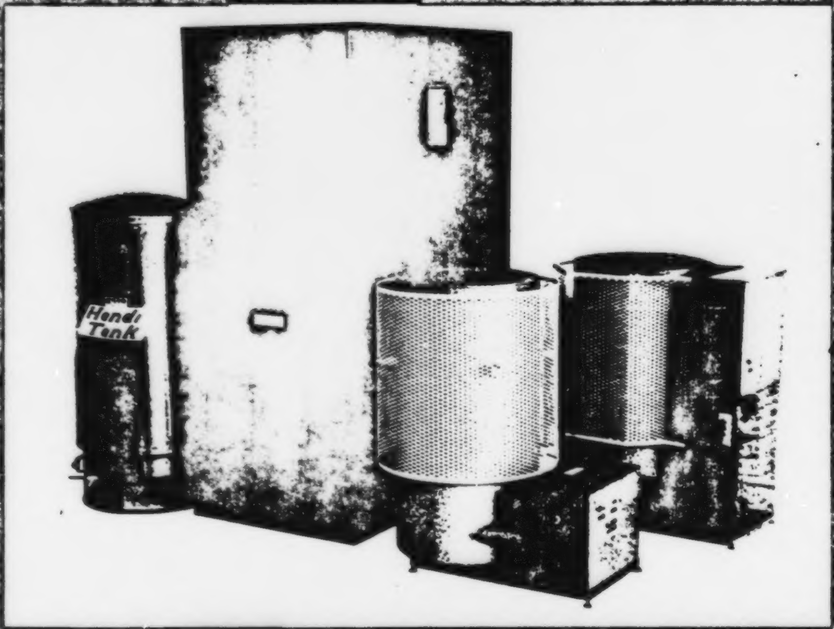
N. 1419 Thierman
Spokane, WA 99212
(509) 534-1022
1-800-255-1363

DEALER IMPRINT

VAPOURIZING HEATERS

IMPROVE YOUR PROFIT MARGIN

With The Original American Waste Oil Heater From Kutrieb



KUTRIEB
CORPORATION

KUTRIEB

Waste Oil Heaters

DESIGNED AND MANUFACTURED IN WISCONSIN BY THE OLDEST MANUFACTURER OF WASTE OIL HEATERS IN THE UNITED STATES. THOUSANDS HAVE BEEN BUILT SINCE 1975.

Simple to install—Easy to operate—

- **No Compressed Air Required:** COMPRESSED AIR IS NOT CHEAP! Running your air compressor 24 hours a day to operate a heater costs money. . . Do you run yours at night?
- **No Electric Pre-heating Necessary:** Kutrieb Heaters DO NOT USE electric pre-heating elements of any kind. The result—lower electric bills.

Environmentally Sound Operating Principle:

- Unlike High Pressure Atomizer Burners which spew pollution into the air, Kutrieb heaters gently vaporize waste oils leaving pollutants (including silicas, lead and heavy metals) to collect inside the heater for easy disposal as solid waste.

Minimum maintenance

- **No High Pressure Nozzles to Clog or Replace:** Our heaters burn all types of waste oils from automatic transmission fluid to heavy diesel oil. They also burn clean fuels.

Advanced 250

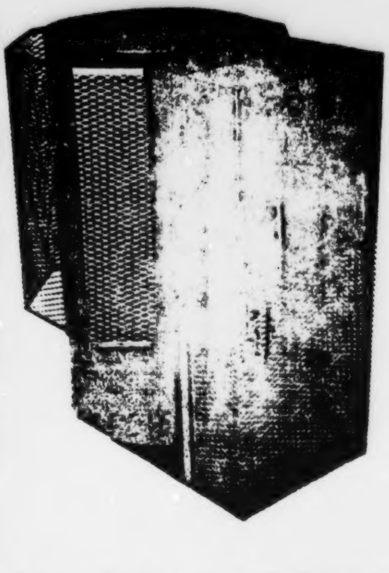
Our most powerful heater

Years of advanced technology and engineering are housed in this contemporarily designed unit. It represents the "state of the art".

- Install free standing or overhead
- Industrial high volume circulation blower system
- Adaptable for use with duct work
- Industrial quality heavy gauge construction
- Electronic overflow and overheat protection
- Connects to *Handi Tank* or other remote fuel source

SPECIFICATIONS:

MODELS	ADVANCED 250
BTU Hour Rating Maximum @ Sea Level	Up to 250,000
Area Heated—Cubic Ft.	100,000-200,000
Oil Consumption—U.S. Gal./hr. Maximum @ Sea Level	1.80
Electric Power	115 V/60 Hz
Dimensions, H/W/D in.	72" x 29" x 47"
Weight—Lbs.	500
Blower Pressure/CFM Maximum	0.12/4,500
Flue Pipe	8"



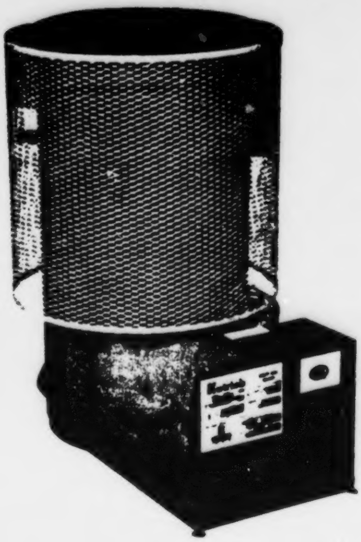
The Original CTB-87

Simplicity and reliability, good ideas go on and on. . .

This **patented** Pioneer from Kutrieb has lived on to become the most popular convection-radiant heater in America.

If you're looking for the most BTU's for your dollar you couldn't make a better choice.

- **Patented** Kutrieb volumetric fuel metering system
- Wall-mounted thermostat
- Heavy steel and cast iron construction
- Exclusive **patented** Kutrieb **Easy Clean**™ residue removal system allows the heater to operate continuously for up to 60 hours
- Self contained 6 gallon fuel tank No remote fuel source necessary



"NEW" HT-87

Affordably Priced — Easy to operate

Same reliable performance as CTB-87 but designed to connect to 55 gallon *Handi Tank*™

Eliminates daily refueling.

- Quiet convection-radiant heat
- **Patented** Kutrieb volumetric fuel metering system
- Wall-mounted thermostat
- Heavy steel and cast iron construction
- Exclusive **patented** Kutrieb **Easy Clean**™ residue removal system allows the heater to operate continuously for up to 60 hours

YOUR TIME & BACK-SAVER

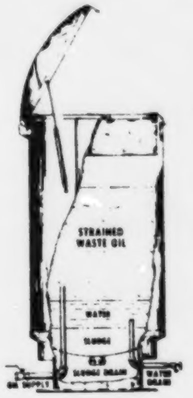
Handi Tank™

The Ingenious Accessory For Waste Oil Heaters

Pays for itself in time savings alone.

- **Less Cleaning**
- **Fewer Shutdowns**
- **Lower Maintenance**
- **Provides sufficient fuel to operate most heaters over entire weekend.**

Strains
Stores
Separates



Total Convenience

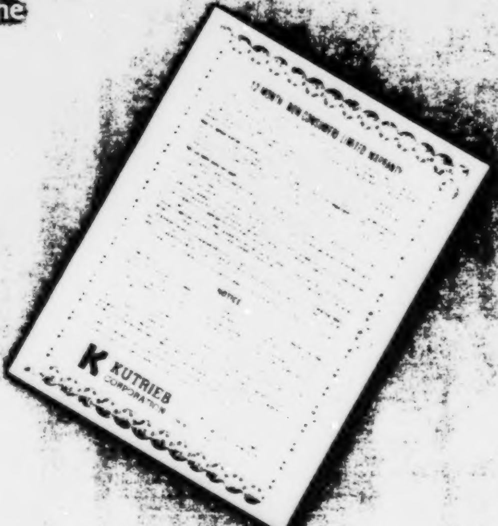
- **Gas spring operated lid opens on the push of a button**
- **Filter screen basket lifts out for cleaning**
- **Separate drain allows water removal at any time**
- **Vertical "Space-Miser" design saves floor space**

ORIGINAL CTB-87	HT-87	HANDI TANK
87,000	87,000	Filter Basket: cap. 9.0 gal.
24,000-48,000	24,000-48,000	Screen: 100 mesh stainless
.63	.63	Filter Area: 418 sq. in.
115 V/60 Hz	115 V/60 Hz	Tank Cap.: 50.0 useable
38" x 26.5" x 30.5"	38" x 26.5" x 30.5"	Height: 49" (lid closed),
170	170	Diameter: 24"
N/A	N/A	Shipping Wt. 70 lbs.
6"	6"	Floor Space Req. 4 sq. ft.

THE KUTRIEB GUARANTEE OF QUALITY AND SERVICE

OUR WARRANTY TO YOU...

Kutrieb's no nonsense warranty accompanies every waste oil heater shipped.
Any part that is found to be defective due to materials or workmanship will cheerfully be replaced for the full term of the warranty.
A copy of the complete warranty can be obtained on request prior to purchase.


NOTICE
KUTRIEB CORPORATION

SAFETY TESTING AND APPROVALS

Tested—Safety
R.L.T. Laboratory Applicable Criteria-U.L. Standards 296, 731, 896 and Gasoline Hazard test.

Tested—Particulate Emission
EPA 1, 2, 3, 4, 5, 6 & Lead

Approved—Wisconsin DILHR
Safety and Buildings Div.
Approval #821201

Approved—Michigan
Dept. Labor Construction
Code Commission
Approval #1187MA

N.F.P.A.—The National Fire Protection Association Standard No. 31 Section 1-10 makes provision for the use of crankcase oils as fuel in units designed to burn such oils.

A new source of profit—Kutrieb Waste Oil Heaters

The ideal auxiliary commercial and industrial heat source for your auto dealership, service station, car wash, fleet operation, farm implement dealership, trucking company, farm maintenance shop, marine center, aircraft repair facility, heavy equipment repair shop, railroad, factory, municipal maintenance garage, military installation, laundromat, or greenhouse.

Kutrieb Heaters typically pay for themselves in a matter of months. From then on—IT'S PROFIT...

KUTRIEB CORPORATION
430 Phillip Street, Chetek, WI 54728

Order Toll Free
1-800-826-6710
— In Wisconsin dial (715) 924-4871 —

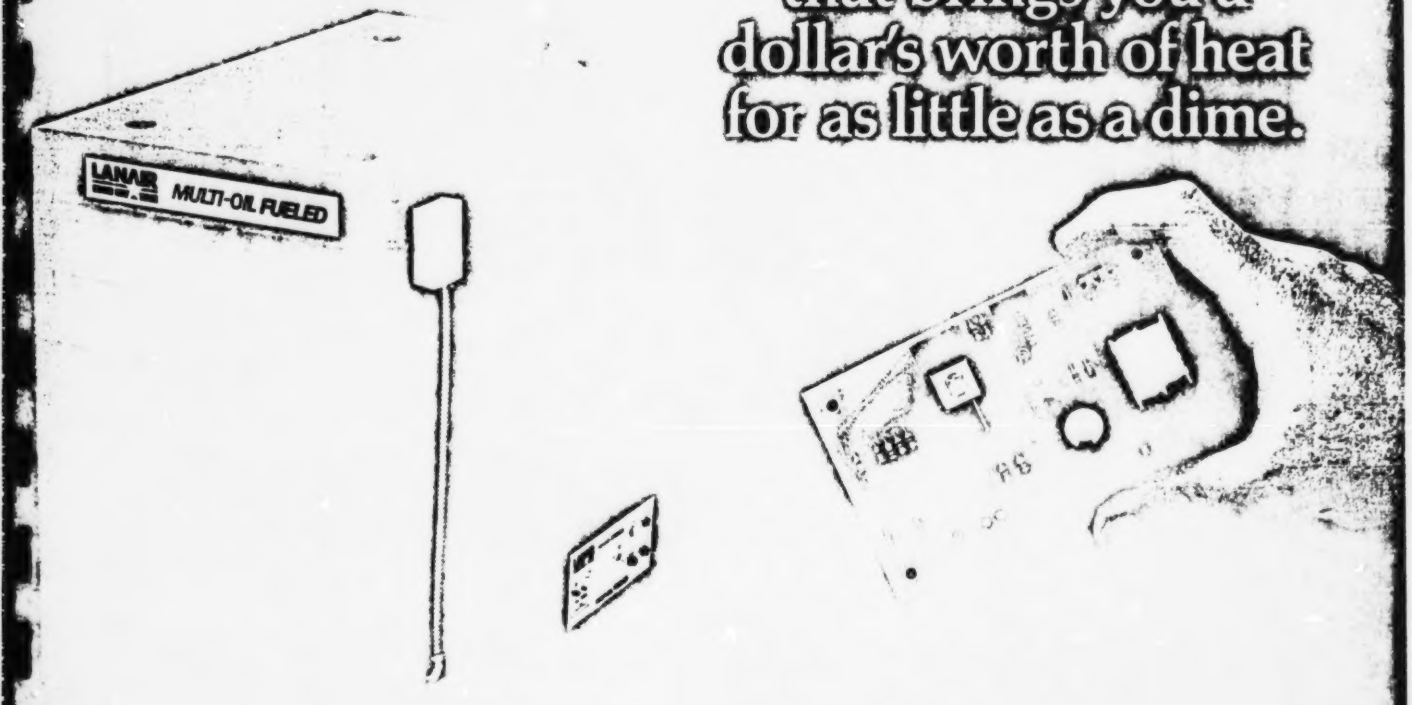
VISA MasterCard
VISA and MasterCard Welcome

NOTICE! Waste Oil Heaters should be installed in compliance with applicable codes. In some locations codes may not permit the use of waste oil heaters.
Prices and specifications subject to change without notice.

Copyright 1987

Waste Oil Fired Heaters

Advanced technology that brings you a dollar's worth of heat for as little as a dime.



The Lanair Model LV-110 Waste Oil Fueled Heater can help you slash conventional heating costs by as much as 80% ; safely and efficiently turning a wide variety of fuels into inexpensive heat, without smoke or odor. The LV-110 is designed to provide supplement heat for 2 to 3 service bays or work areas from 1500 to 3000 sq. ft.

MODEL

LV-110

Multi Oil Fueled Heaters

LV-110

How it Works

The Lanair Model LV-110 delivers abundant quantities of clean, odorless heat through a process called vaporization. Vaporization, begins when a precisely metered amount of oil is injected onto a preheated vaporization plate. Contaminants are left behind in the form of an ash-like residue, which is easily removed on a routine basis. The pollution-free oil vapor rises into a unique combustion chamber, where it is mixed with the exact amount of air necessary for rapid, complete burning and optimum heat generation.

Combustion Chamber

Through state-of-the-art design, the unique combustion chamber precisely and completely burn the fuels injected into it for maximum heat output and energy.

Heat Delivery

The LV-110 combines a side-flow heat exchanger with a forced-air axial blower to provide much more heat than conventional designs. This highly efficient system captures and utilizes valuable heat that might otherwise escape.

Easy Maintenance

Another first in the industry is the single piece clean out element. This element is easily removed with only one hand and can be cleaned and replaced within minutes.

Computer Command Control

Computer Command is an exclusive Lanair feature that uses the latest in solid-state electronic technology to provide maximum safety, unparalleled combustion efficiency and low maintenance. A pre-programmed microprocessor includes a wafer thin 3" × 5" card that monitors and controls the complete operation of the LV-110; generating consistent and economical heat.

Fuel Pump

The fuel pump is a positive displacement, gear driven piston metering pump, designed and built by Lanair engineers. Key pump components are made of stainless steel for wearability and dependable performance. The submerged pump is designed to deliver a metered amount of fuel across a wide variety of burnable fuels, varying in contamination and viscosity.

Ceiling Mountable

Where space is premium this unit can be ceiling hung 6-10 ft. off the ground. Preferred height 7 ft.

Payback Period

The Lanair LV-110 will generally have a payback period of approximately two heating seasons or less, depending on usage, fuel and geographic location.

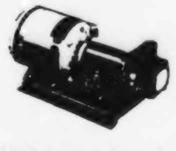
Specifications for LV-110

Combustion Technique:	Vaporization
Heat Disbursement Range:*	70,000-100,000 (BTU/Hr.)
Area Heated:	2,000-3,000 (Sq. Ft.)
Oil Consumption:	.57 (Gal./Hr.)
Fuel Tank Capacity:	Remote Tank
Electric Power:	115 Volts (AC 60 Hz)
Dimensions:	29 1/2 × 24 × 51 1/2 (H/W/L In.)
Weight:	275 (Lbs.)
Flue Pipe:	6 In. (O.D.)
Forced Air Blower:	2,000 (CFM)
Combustion Blower:	60 (CFM)
Electric Draw:	5 (Amp)

Tested and certified by P.F.S. and C.S.A.

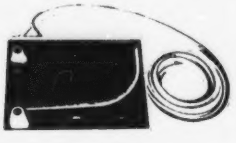
*Heat output varies depending upon fuel used.

ACCESSORIES



2432 Auxiliary Pump & Motor

Pumps from auxiliary tank to heater inboard tank.



Manometer 0005

Helps achieve maximum heating efficiency through constant readout of flue pipe draft.

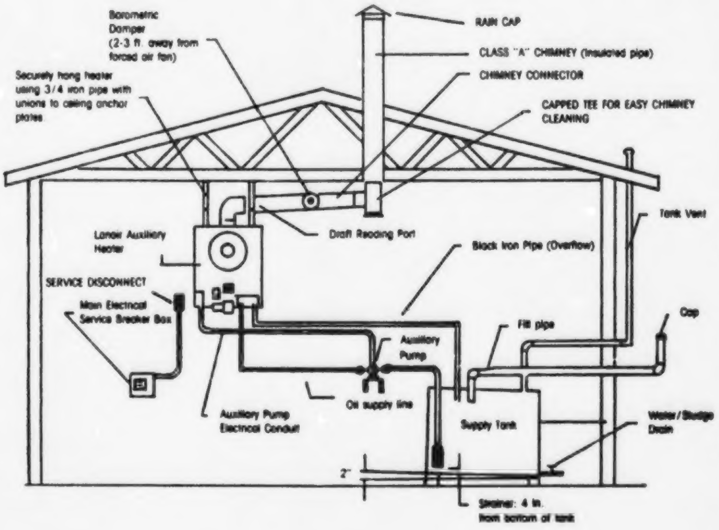
Barometric Damper

Compensates for changes in atmospheric pressure. Available in 6" and 8".

8748 50 Mesh Strainer

and check valve for pump suction.

Typical Heater Installation


Barometric Damper (2-3 ft. away from forced air fan)
Securely hang heater using 3/4 iron pipe with unions to ceiling anchor plates
RAIN CAP
CLASS "A" CHIMNEY (Insulated pipe)
CHIMNEY CONNECTOR
CAPPED TEE FOR EASY CHIMNEY CLEANING
Tank Vent
Lanair Auxiliary Heater
Draft Reading Port
Black Iron Pipe (Overflow)
SERVICE DISCONNECT
Main Electrical Service Breaker Box
Cap
Fill pipe
Auxiliary Pump
Oil supply line
Auxiliary Pump Electrical Conduit
Supply Tank
Water/Sludge Drain
2"
Strainer: 4 in. from bottom of tank

SOLV-X® INVENTIONS LTD.

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Box 38, Norwood Grove Winnipeg, Manitoba, Canada R2H 3B8
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EDMONTON, AB
CANADA T6C 4G2

L-220E

Floor mounted auxiliary heat source for commercial and industrial use

How it Works

The Lanair Model L-220E operates on an extraordinarily simple, yet efficient combustion system that delivers abundant quantities of clean, odorless heat. This process, called vaporization, begins when a precisely metered amount of oil is injected onto a preheated vaporization plate, where it immediately vaporizes. Any contaminants are left behind in the form of an ash-like residue, which is easily removed on a routine basis. The pollution-free oil vapor rises into a unique combustion chamber, where it is mixed with the exact amount of air necessary for rapid, complete burning and optimum heat generation.

Computer Command Control

Computer Command is an exclusive Lanair feature that uses the latest in solid-state electronic technology to provide maximum safety, unparalleled combustion efficiency and low maintenance. A pre-programmed microprocessor includes a wafer thin 3" × 5" card that monitors and controls the complete operation of the L-220E; generating consistent and economical heat.

Combustion Chamber

Through state-of-the-art design, the combustion chamber is engineered to precisely and completely burn the fuels injected into it. Air and fuel are injected at the right moment and in just the exact amounts for complete combustion and maximum heat output.

Heat Delivery

Reflecting Lanair's commitment to unmatched quality and performance, the L-220E combines a tubular-flow heat exchanger with a forced air axial blower to provide much more heat than conventional designs. This highly efficient system captures and utilizes valuable heat that might otherwise escape.

Fuel Pump

The fuel pump is a positive displacement, gear driven piston metering pump, designed and built by Lanair engineers. Key pump components are made of stainless steel for wearability and dependable performance. The submerged pump is designed to deliver a metered amount of fuel across a wide variety of burnable fuels, varying in contamination and viscosity.

Easy Maintenance

Maintenance is simple and convenient with the L-220E. The bottom cleanout hatch makes it easy: Shut down the unit to cool, open the cleanout hatch door, scrape out the residue, refire the unit and close the door. Frequency varies with the fuel used, but once a day is generally a good rule-of-thumb.

Cabinet Design

The compact, easy-to-install design of the L-220E reflects the expertise of an engineering team that understands multi oil heaters. Aerodynamic, adjustable louvers allow maximum free-flow of air to heat your facility.

Payback Period

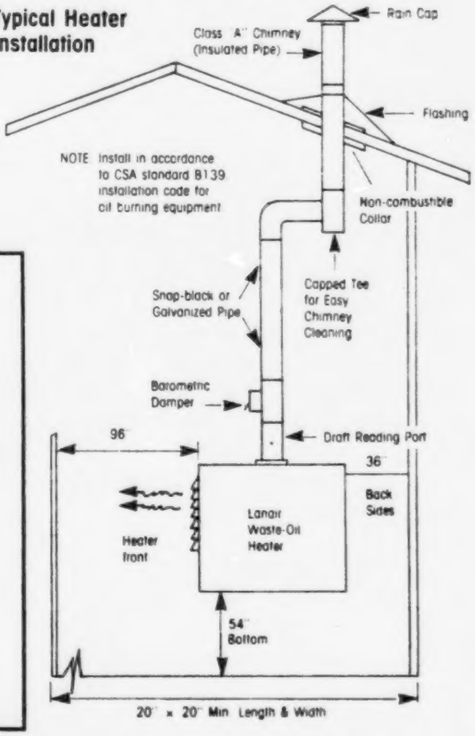
The Lanair L-220E will generally have a payback period of approximately two heating seasons or less, depending on usage, fuel and geographic location.

Specifications for L-220E

Combustion Technique:	Vaporization
Heat Disbursement Range: *	160,000-200,000 (BTU/Hr.)
Area Heated:	4,000-7,000 (Sq. Ft.)
Oil Consumption:	4.61 Imp. Liters/Hr. 1.01 Imp. Gal./Hr
Fuel Tank Capacity:	37.9 Imp. Liters 8.3 Imp. Gal.
Electric Power:	115 Volts (AC 60 Hz)
Dimensions:	57 1/2 × 29 × 41 (H/W/L In.)
Weight:	498 (Lbs.)
Flue Pipe:	8 In. (O.D.)
Forced Air Blower:	2,800 (CFM)
Combustion Blower:	150 (CFM)
Electric Draw:	6 (Amp)

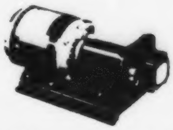
Stainless steel burner pot and diffuser ring.
Tested and certified by P.F.S. and C.S.A.
*Heat output varies depending upon fuel used.

Typical Heater Installation

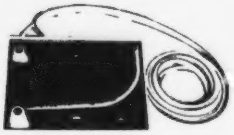

Rain Cap
Class "A" Chimney (Insulated Pipe)
Flashing
NOTE Install in accordance to CSA standard B139 installation code for oil burning equipment
Non-combustible Collar
Snap-black or Galvanized Pipe
Capped Tee for Easy Chimney Cleaning
Barometric Damper
Draft Reading Port
96"
36"
Back Sides
Lanair Waste-Oil Heater
Heater front
54" Bottom
20' × 20' Min Length & Width

ACCESSORIES

1223 Remote Control
Switching Device
Automatically switches pump to fill inboard tank from auxiliary tank.



2432 Auxiliary Pump & Motor
Pumps from Auxiliary tank to heater inboard tank.



Manometer
Helps achieve maximum heating efficiency through constant readout of flue pipe draft.

Barometric Damper
Compensates for changes in atmospheric pressure.
Available in 6" and 8".

8748 50 Mesh Strainer
and check valve for pump suction

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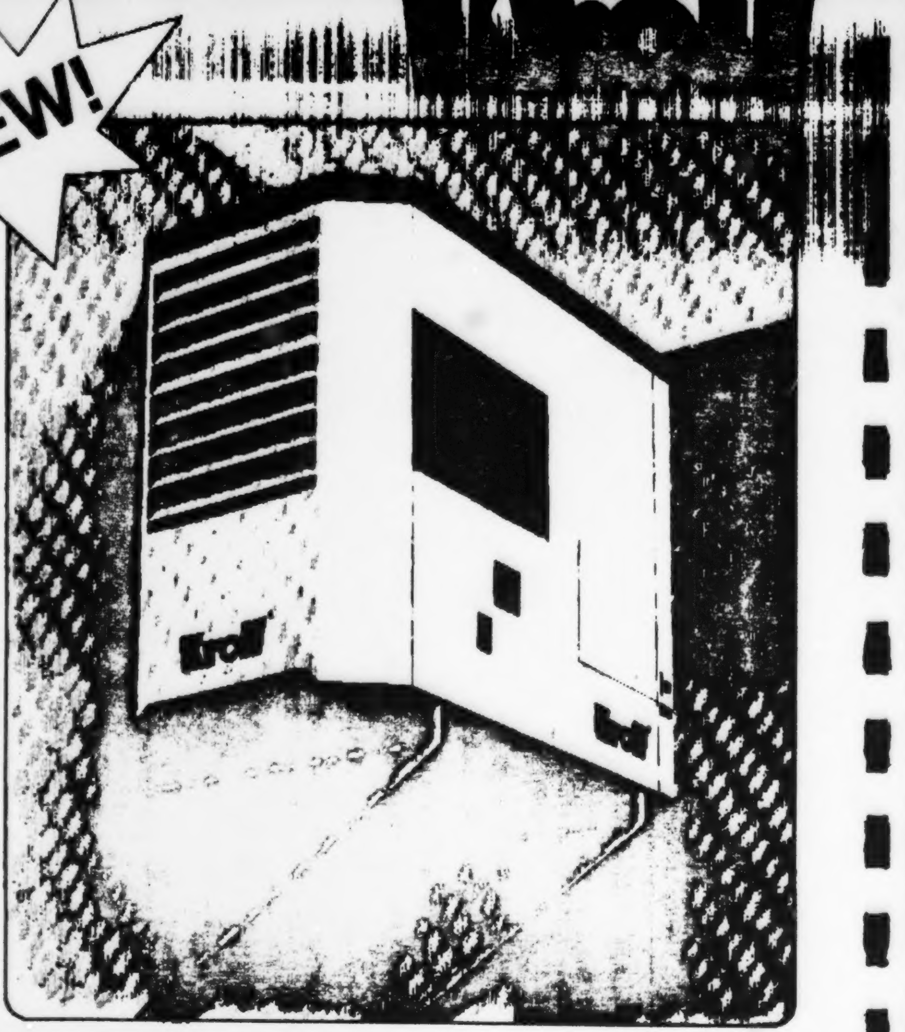
NEW!

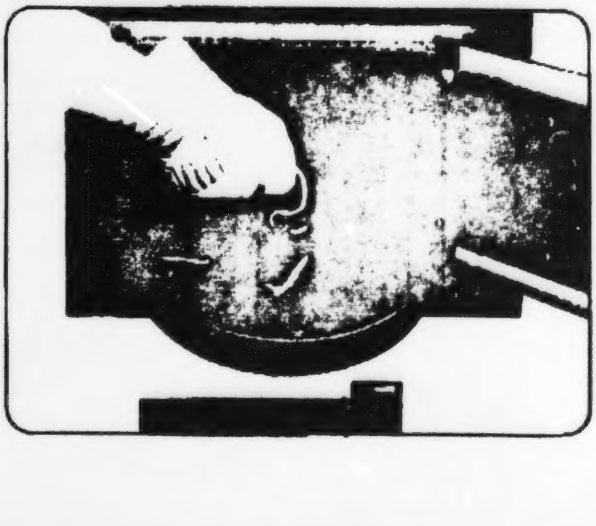


Original thinking and
twenty years of
experience
combine to produce
a new type of
heat exchanger and
air distribution system.
Efficiency has been
further improved.

Model K 410 Waste Oil-fired Heater

The ideal variant: The Kroll K410. Free standing, wall or suspended fitting. Even with a limited amount of space you can still enjoy a first-class Waste oil-fired heating system.

Cleaning is simple.
The large side-mounted access doors allow burner components to be rapidly removed for cleaning.



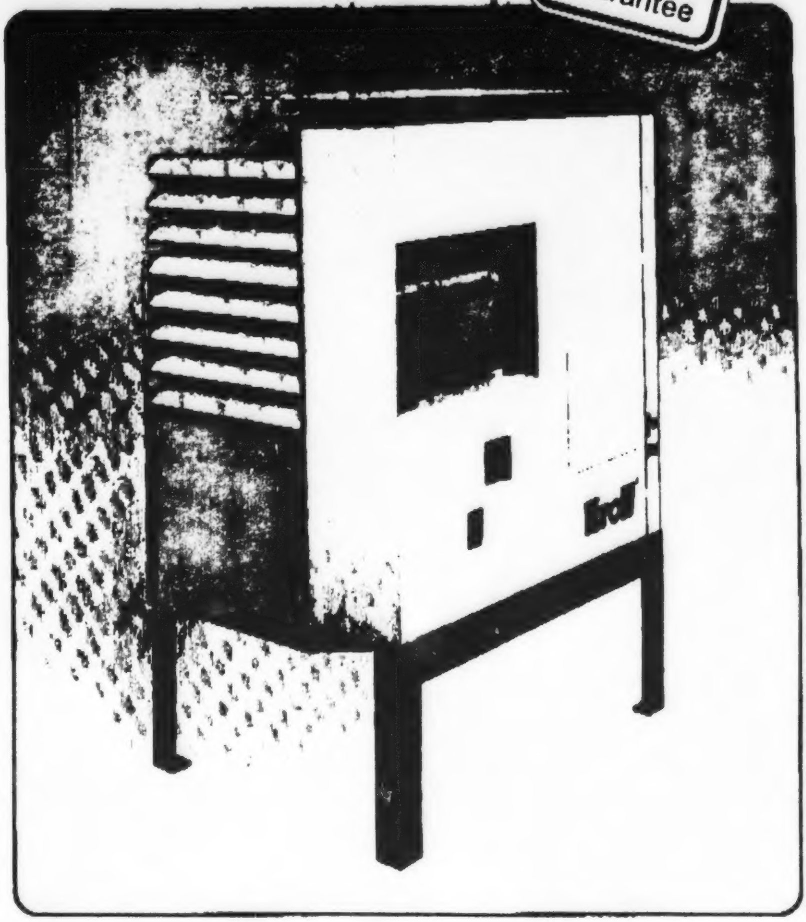
Environmental as never before. Energy-conscious to the last drop: the K410

12 months Guarantee

Among the experts, Kroll has long been known for its ability to combine superb engineering with unsurpassed efficiency. But to the pioneering spirit and inventive aspirations of the Kroll engineers and designers the steadily-growing call for energy conservation represented a new challenge to product improvement. In the K410 they have achieved a decisive breakthrough.

New-type Heat Exchanger System

Kroll now offers the most advanced system available in this sector. Efficiency has been improved by up to 90%, to a new peak for vapourising pot burners. Twenty years of specialist expertise have paid off in every area, enabling the proven W400 burner system to be successfully developed still further. More intensive air circulation generates heat more rapidly and delivers it in greater intensity to wherever it is needed. The heat exchanger and tank are integrated into a single housing.



Handermender GmbH · Göhring Druck GmbH

Compact Design

The Kroll engineers also set out to achieve compactness of size. As a result, all projecting components have been eliminated and users are able to benefit from a choice of free-standing or suspension-mounted systems, depending on structural considerations. Thus the suspension-mounted version comes into its own wherever floor space is at a premium. Whether mounted on the wall or ceiling, the K410 requires very little room, leaving valuable floor-space entirely free.

Environmental Combustion

In this area, too, the Waste Oil-fired Heater K410 stands out by virtue of its improved performance characteristics. Simplicity of control is equally user-friendly. The side-mounted doors provide easy, convenient access to burner.

Clean Industrial Design

In design the K410 has likewise been given a modern look, featuring smooth front panels, compact dimensions and robust stove-enamelling in a functional, neutral shade of grey.

Technical Data	K 410
Heat output	up to 150 000 Btu/hr
Approx. heating area	2 500 – 5.000 sq.ft
Height (without legs)	1090 mm/3'7"
Height (with legs)	1410 mm/4'6"
Width	700 mm/2'3"
Depth	1100 mm/3'7"
Flue diameter	150 mm/6"
Tank capacity	27 liters/6.75 US gal.
Fuel consumption (approx.)	0.65 gal/hr
Electrical	110 V/8 amps
Warm air blower	1 500 CFM
Weight	125 kg/275 lbs
Color	light grey/charcoal

YOUR DEALER:

MULTIFUEL INC.
320 Bell ,
Cowanville, Que.
J2K-3E2 ph (514) 263-1490

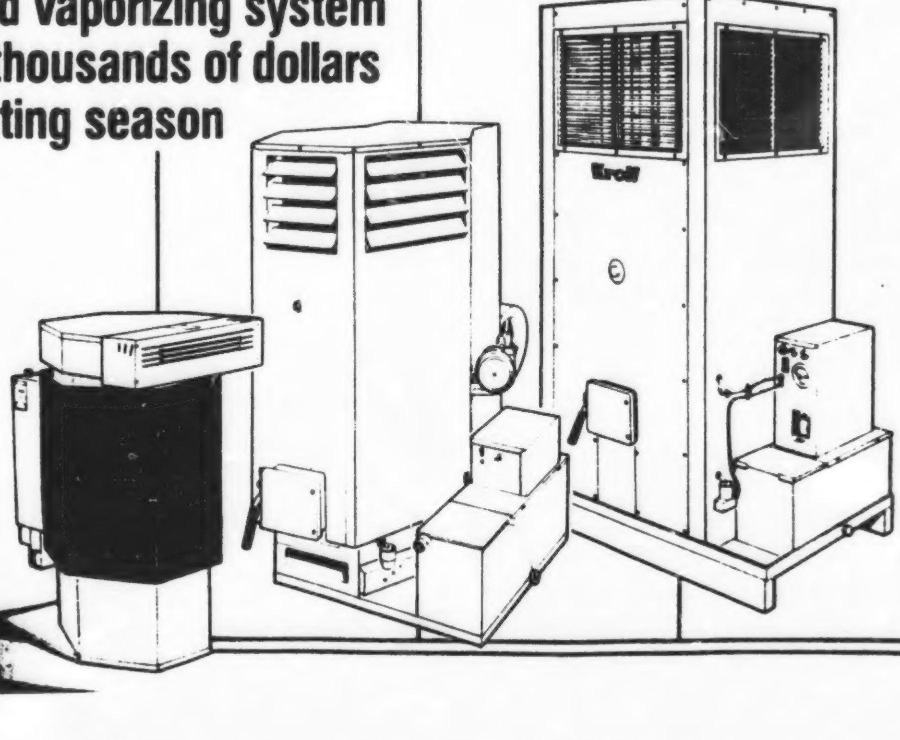
In short: The Kroll K 410 – a new product which has rapidly achieved the accolade of excellence from all sides.

tel : 514 263 1490

Kroll®

Kroll multi-oil fired heaters turn drain oil into free heat!

Kroll's patented vaporizing system can save you thousands of dollars in a single heating season

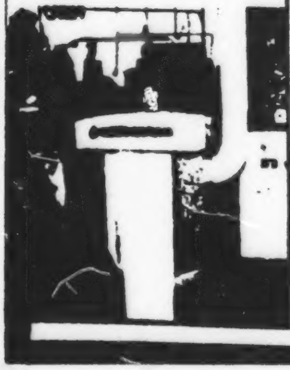


Kroll heaters convert crankcase and tra
efficient heat at a fraction of the cost of

Kroll, the world's largest manufacturer of multi-oil fired heaters, has developed over the past two decades the technology to help you save thousands of dollars in heating costs. Proven in the United States, and world wide, Kroll heaters produce more heat, require less maintenance and are more fuel efficient than any comparable waste oil heater.

CASH FLOW vs. OIL FLOW

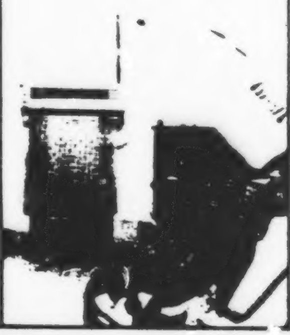
Each year, service station operators and repair shop managers are burning up profits and straining budgets to heat service areas. The cost of energy is steadily rising. Utility rate increases are making front page news across the country. Businessmen just like you will bear the financial burden **unless** you become more self-sufficient. Now you can. Kroll will help you do it.



PATENTED VAPORIZING SYSTEM

The heating power of crankcase drain oil and transmission fluids is equal to or higher than normal heating fuel. Those same waste products that you have to store and recycle in return for pennies a gallon can save you thousands of dollars in heating costs. Kroll developed a patented vaporizing system that burns waste oils with fewer emissions, less odor and a higher heat output than any other multi-oil fired heater.

Kroll heaters have been approved by more regulatory and safety agencies than any other brand. All Kroll heaters are tested and listed to UL criteria by E.T.L.M. The Kroll vaporizing system has been selected by the Environmental Protection Agency and the Department of Energy for a special research project.

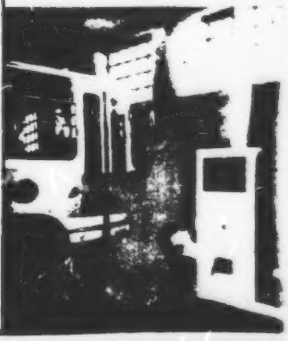


COST-SAVING TECHNOLOGY

With two decades of worldwide experience more than 80,000 installations international approval and a patented process Kroll technology can save you money. With Kroll's line of multi-oil fired heaters you can generate from 120,000 to 380,000 BTU/hr delivered to your work area by efficient heat exchangers and forced air blowers. You will save additional money through increased productivity of your employees in a comfortable work environment.

LOW MAINTENANCE — HIGH EFFICIENCY

Even waste oil can't foul the patented vaporizing system or the heating efficiency of a Kroll heater. Waste oil is refined by the system to remove noncombustible and metallic components. As a result there are minimal deposits of contaminants in the heat exchanger and lowest particulate matter in the emissions. That means clean, odorless, efficient combustion. Heat from your waste oil — environmentally safe and free!



Kroll®

..with Kroll

PERFORMANCE FEATURES

- Patented Vaporizing System
- Multi-Oil Capacity
- Dual Heating Range
- Ignition Safety
- Heavy Duty Construction
- Quality Engineering
- Environmentally Safe
- Limited 12-Month Warranty

OPTIONS:

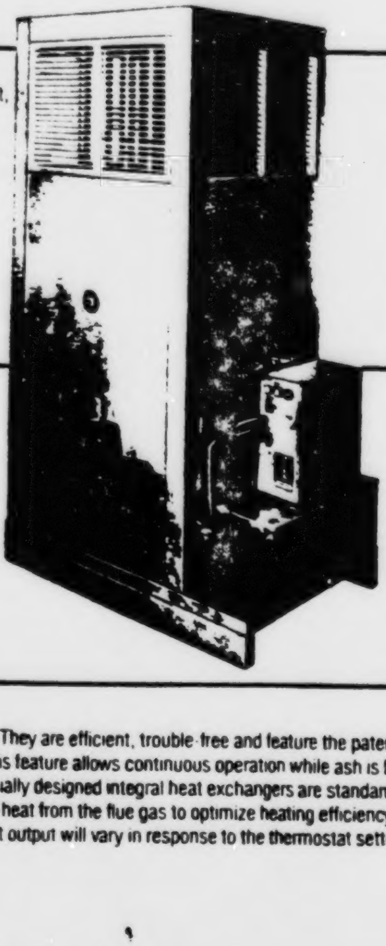
- Remote Thermostat Control
- Remote Fuel Supply

W400VL

The W400VL is equipped with an efficient forced air blower to heat larger areas. Heat dispersement in three selective directions

SPECIFICATIONS	Model W400VL
Heat range	from 60,000 to 120 000 Btu/hr
Fuel consumption	from 5 to .75 gal/hr
Approx. heating area	3,000 to 4,000 sq. ft
Dimensions H/W/D	3'10"x2'3"x27"
Flue diameter	6 inches
Approximate weight	205 lbs
Electrical	110 V/4 amps
Warm air blower	350 CFM
Color	Silver/Charcoal

or proven design and the highest heat output per dollar of heater cost, arantees efficient and trouble-free operation



KT 800

When heating of larger areas is required, Kroll's midrange model KT 800 will meet the demand. The same quality features of the KT 500 are incorporated into this larger unit

SPECIFICATIONS	Model KT800
Heat range	from 160,000 to 240,000 Btu/hr
Fuel consumption	from 1.0 to 1.5 gal/hr
Approx. heating area	5,000 to 12,000 sq. ft
Dimensions H/W/D	5'8"x3'4"x2'10"
Flue diameter	7 inches
Depth at blower	3'5"
Approximate weight	530 lbs
Electrical	110 V/10 amps
Warm air blower	1,500 CFM
Color	Silver/Charcoal

KT 1000

The KT 1000 is designed for top performance and the highest heat output of any multi-oil fired heater. Installation is simp and flexible. A powerful centrifugal blower will disperse hea directly through adjustable louvers or supply heat to remote areas through simple duct work connections. Heat wherever you need it at a fraction of the cost of heating with fuel oil gas or electricity

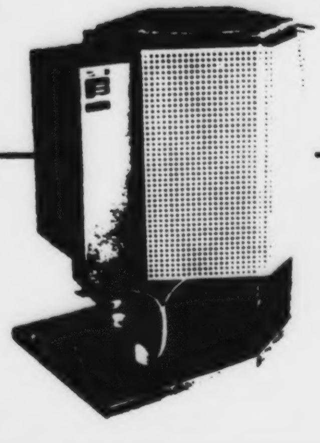
SPECIFICATIONS	Model KT1000
Heat range	from 270,000 to 380,000 Btu/hr
Fuel consumption	from 1.7 to 2.4 gal/hr
Approx. heating area	6,000 to 15,000 sq. ft
Dimensions H/W/D	6'3"x3'3"x2'5"
Flue diameter	10 inches
Depth at blower	3'11"
Approximate weight	750 lbs
Electrical	220 V/10 amps
Warm air blower	3,400 CFM
Color	Silver/Charcoal

KT Series.

The popularity of the KT series is well established. They are efficient, trouble-free and feature the patented, highly refined Kroll bottom ash removal system. This feature allows continuous operation while ash is being removed. Shut down is not required. Efficient, specially designed integral heat exchangers are standard equipment. Large heat exchanger surfaces extract heat from the flue gas to optimize heating efficiency. Remote thermostats permit semi-automatic operation. Heat output will vary in response to the thermostat setting

mission drain oils into clean,
el oil, gas or electricity

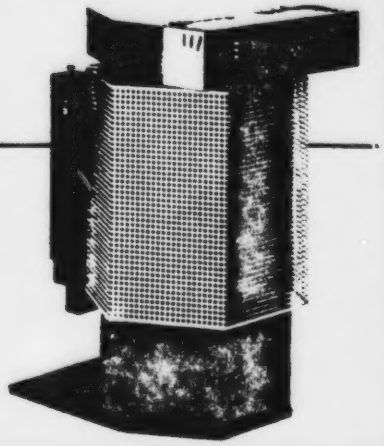
Five ways to cut heating costs...w



W400L

The World's most popular multi-oil heater provides heat dispersement at dual range through radiation and convection

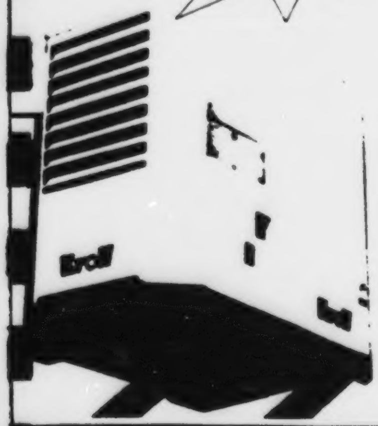
SPECIFICATIONS	**Model W400L**
Heat range	from 60,000 to 120,000 Btu/hr
Fuel consumption	from .5 to .75 gal/hr
Approx. heating area	2,000 to 2,500 sq. ft
Dimensions H/W/D	3'4"x2'3"x27"
Flue diameter	6 inches
Approximate weight	165 lbs
Electrical	110 V/2 amps
Color	Silver/Charcoal



W400 Series

Kroll's W400 series are the world's most popular multi-oil fired heaters. These models, though low in cost, maintain the usual high standard of Kroll quality. If you are looking for proven des the W400L or the W400VL is the correct choice. Installation is simple and quick, so is maintenance. Simply removing the ash, usually done in the morning before start-up, guarantees effi

NEW



K 410

With twenty years of engineering excellence and experience Kroll is proud to introduce the new energy and space-efficient K 410. Suspension mounted from wall or ceiling, the K 410 integrates both heater and tank housing, generating high intensity air circulation, while freeing up valuable floor space. Large, side-mounted doors allow for easy cleaning while our improved user control has increased efficiency by 90%.

The compactness of the K 410, combined with the most advanced heat delivery system available, makes this model the ideal choice.

SPECIFICATIONS	**Model K 410**
Heat range	from 65 000 to 125 000 Btu/hr
Fuel consumption	from .5 to .75 gal/hr
Approx. heating area	2 500 to 5 000 sq. ft
Dimensions H/W/D	37" (with legs 46")x23"x37"
Flue diameter	6 inches
Approximate weight	275 lbs
Electrical	110 V/8 amps
Warm air blower	1,500 CFM
Color	Light Gray/Charcoal

— CSA
approved for
use in Canada
as of April 1986

KT 800

When hea
model KT 8
features of

SPECIFICAT
Heat range
Fuel consur
Approx. hea
Dimensions
Flue diamet
Depth at bl
Approxima
Electrical
Warm air bl
Color

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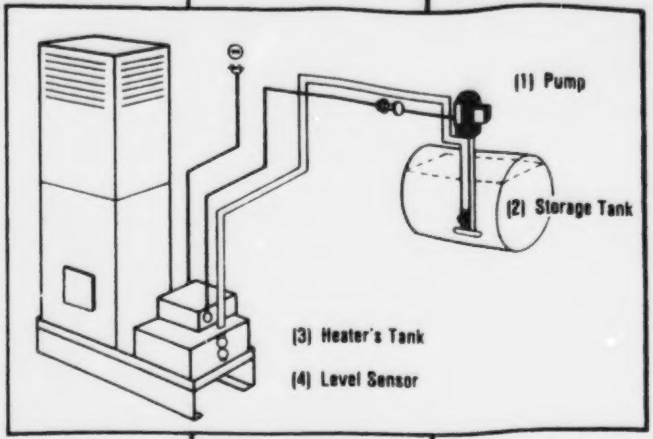
* Refer to appropriate local and state agencies for proper installation and operation of all heating appliances

In order to maintain our policy of continuous product improvement, we reserve the right to change prices, specifications, ratings or dimensions without notice or obligation notice.

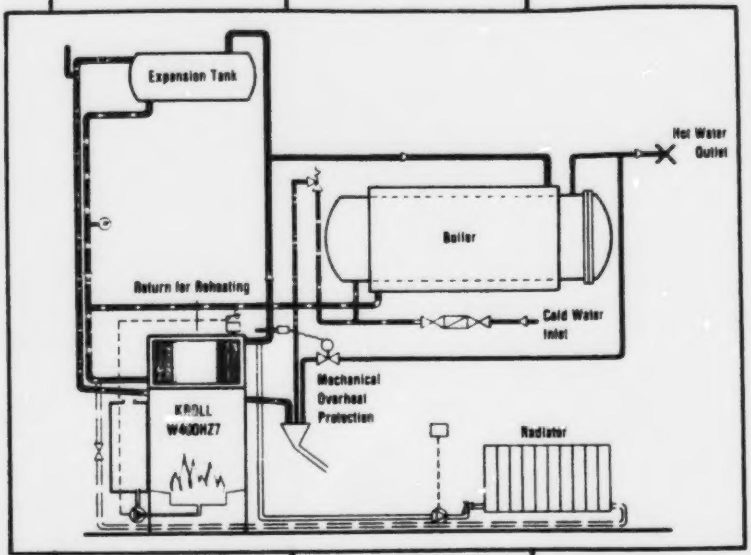
(Copyright 1984 Walter Kroll GmbH)

Remote Fuel Supply...a time-saving component to complete your Kroll multi-oil fired heater system


(1) Pump
(2) Storage Tank
(3) Heater's Tank
(4) Level Sensor

A labor saving option for all KROLL heater models' Designed specifically for waste oil, the KROLL Remote Fuel Pump **(1)**, automatically transfers fuel from a remote storage tank **(2)**, to the heater's tank **(3)**, controlled by an accurate level sensor **(4)**.

Hot Water Heater...W400HZ7 produces hot water from used oil


Expansion Tank
Hot Water Outlet
Boiler
Return for Reheating
Cold Water Inlet
KROLL W400HZ7
Mechanical Overheat Protection
Radiator

The Hot Water Tank H Z 7 is used with the heater W 400 in place of the blower V 450 Heat space and water in winter and water only for the rest of the year. Install to supplement existing boiler capacity or with separate expansion reservoir (see schematic), with up to 80 gallons! Built in thermostat

Consumer Data

The National Fire Protection Association Standard #31, section 1-10, December 1982 provides for crankcase oils and transmission fluids to be burned as fuels in units designed to burn those fuels.

All Kroll heater models are tested and listed to UL criteria by E.T.L.M. for burning of these oils in industrial and commercial applications.

Federal emission testing by the U.S. Environmental Protection Agency and the U.S. Department of Energy have proven that Kroll heaters emit 90% less metallic compounds than competing designs.

MISCELLANEOUS

Canadian Standards Association

178 Rexdale Blvd., Rexdale (Toronto), Ontario, Canada M9W 1R3 Telex 06-989344

R 23174
CL 6421
FBL 52256
R8-1988

RECEIVED
MAY 26 1988
OFFICE OF
THE FIRE MARSHAL

May 13, 1988

REGISTERED MAIL

Mr. John Schumacher
Manufacturing Engineer
Lenan Corporation
619 North Parker
Janesville, Wisconsin 53545

Subject: Suspension of Authorization to Use the CSA Mark and Re-investigation and Recall of "Lanair" Model L-220E Used Oil Heaters Certified Under CSA File FBL 52256

Dear Sir,

In confirmation of our telephone conversation of May 9, 1988, our investigation revealed that your model L-220E Used Oil Heater does not comply with the construction details described in your CSA Certification Reports FBL 52256-8 dated November 30, 1987 and FBL 52256-3,-4, dated March 5, 1984.

The noncompliances are as follows:

i An adjustable timer has been added.

ii The pump motor is a Dayton model 3M101. A Brevel motor model 703-982419 is listed in the CSA Report.

iii A Dayton model 4C446 motor, rated at 1.5 Amp., is used for the combustion air blower. Your CSA Report specifies a Fasco motor rated at 1.8 Amps.

iv The Honeywell type Q340A thermocouple has been replaced with an unidentifiable thermocouple.

continued....../2

MAY 30 1988
318
G.N.W.T.

rcf/20

v The printed circuit board is different (components and circuitry changes) from that described in your Certification Reports.

vi There is no air proving switch as described in Fig. 48 of your CSA Reports.

vii The combustion air inlet opening is not fixed at 5/16" as described in Fig. 36 of your CSA Reports.

viii The CSA Registered Mark appears on three caution/warning labels in addition to the main CSA label.

The caution/warning labels are as follows:

- one on the upper right side of the unit that states "Important".
- one at the power entry area.
- one in the control box that also states "Power Connections".

As a result of these changes, the used oil heaters are not eligible to bear the CSA Registered Mark.

To address this misuse of the CSA Mark, you are requested to:

1. Recall the Lanair model L-220E Used Oil Heaters to the factory where it is practicable and:

   - remove the CSA Mark from the product and contact the Provincial Authorities, or
   - rework the product so that it complies with the CSA requirements, and
   - remove the CSA Mark from the caution/warning labels.

   Where it is not practicable to recall some of the units to the factory, the units may be reworked in the field such that they comply with CSA requirements. Arrangements can then be made for CSA Special Acceptance of those units that have had the CSA Mark removed.

2. Immediately issue registered letters to your dealers and their customers notifying them of the corrective action that you will be taking with respect to the Lanair L-220E Used Oil Heaters.

3. Provide a complete list of the names and addresses of those who were sent registered letters.

4. Report the quantity of heaters involved including:

   - the number of units that have been shipped and where, and
   - the number of units presently in stock.

continued....../3

rcf/21

5. Advise where we may inspect returned heaters, replacements, and units reworked in the field.

6. Advise us of the quantity of CSA labels and caution/warning labels bearing the CSA Mark currently held in your stock for the product in question. CSA labels may not be used and CSA may require that they be returned. In addition the CSA Mark must be obliterated from the caution/warning labels.

7. Confirm the full details of the measures taken to prevent a recurrence of the misuse of the CSA Mark.

8. If the Lanair Model L-220E Used Oil Heaters are to be reworked or replaced, confirm that the required factory tests will be performed on all units.

9. Provide us with a detailed account of:

   - the number of units returned
   - the number of units reworked in the field
   - the number of units reworked in the factory

Note:

(i) Units which have been reworked or produced as replacements for those units returned and all future production shall be suitably identified to distinguish the units from the recalled version. Your confirmation is required regarding the nature and location of your identifying marking.

(ii) This Suspension of Authorization to Use the CSA Mark and Re-investigation and Recall will remain in effect until we are satisfied that you have complied with Item (1) through (9) above.

(iii) While this Suspension of Authorization to Use the CSA Mark and Re-investigation and Recall is in effect you may not apply the CSA Mark to the product in question unless authorized by CSA. Authorization in this instance means that 100 per cent inspection will be required for this product to ensure that it is eligible to bear the CSA Mark.

(iv) Misuse of the Registered CSA Mark is a serious matter and is contrary to your Agreement with CSA. Misuse of the CSA Mark could result in cancellation of your CSA Service Agreement and possible legal action. We suggest that you review your CSA Service Agreement and in particular Clause 13.

continued....../4

rcf/22

(v) A recurrence of the misuse of the CSA Mark will result in our recommending the cancellation of your CSA Service Agreement.

Please reply fully or give us an interim reply immediately. Also, please sign and return the initial copy of the enclosed forms together with your cheque in the amount noted. This deposit will be applied to the over all costs incurred by CSA in investigating and resolving this matter.

If you wish to discuss any items, feel free to call.

The appropriate regulatory authorities across Canada are being kept informed on the progress of this matter. With your cooperation we look forward to resolving this situation at an early date.

Yours truly,

Ray Sutter, C.E.T.
Special Services Investigator
Audits & Investigations

(416) 747-4274

cc: RS, RF, F/U
Jim Frangakis
Tony Ogborn
CSA Winnipeg
Inspection Files
B500
L76
Mr. Ed Lee
Solv-X Inventions Ltd.
12-1333 Niakwa Road East
Winnipeg, Manitoba
R3C 3G5

encl.

RS/rcf

rcf/23

MULTI-FUEL
320 BELL
COWANSVILLE, QC J2K 3E2
Tel:**(514) 263-1490**
Fax:(514) 263 3356

FAX TO: April 7th.1988.

M. Don Mc LAUGHLIN
BOREAL CONSULTING SERVICES
207, Strickland st.
WHITE HORSE.YUKON.Y 1A 2J7.

Re: MULTI FUEL Waste oil fired warm air furnaces.

Dear Sir,

We refer to our today's phone were we learned you were out of the office for a few days. We got your name last night from H.W.POSUSTA in Toronto, who was contacted by you some time ago. He could not be in touch we us before last night/ due to mortality in his familly.

We are a canadian manufacturer of waste oil furnaces. We were importing from Germany vaporizing type waste oil furnaces since 1980. But we have developped ourselves a " gun- ype " furnace, using most of the components of a regular furnace burner,but with a low pressure air atomizing nozzle, a preheater for both oil and air as well as a special retention head from our own design.

We manufacture here in Cowansville, as well as in Highgate,Vermont, the burners.

We purchase the warm air furnace from York Shipley in Cambridge, Ont. or from their York, Pen. plant for U.S. sales.

Burner & furnace become one entity, the MULTI-FUEL VERSATILE multi-oil fired warm air furnace, tested and listed by ENERGY TESTING LABORATORY OF MAINE, as per U.L. and E.T.L.M. standards.

We have 3 models of furnaces, all completely automatic, operating like regular oil furnaces, on demand of the room thermostat.

Our list prices, FOB Cowansville, fed. tax included, are:

-MO 150	$ 5,495.00
-MO 300	$ 7,495.00
-MO 450	$ 9,495.00

Discount, based on quantities, are negociated with our dealers. We would be glad if you would act as such in your area.

We fax herewith our brochure, and will mail you some tomorrow.

We hope to hear from you in a very near future, please do not hesitate to contact us for any further information you may need.

We remain, sincerely your

R.L.KINTZ

P.S: As we are often in our U.S.location, you may also reach us by phone there at : 802 868 2737

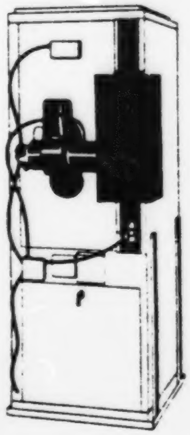
Multi Fuel

Versatile

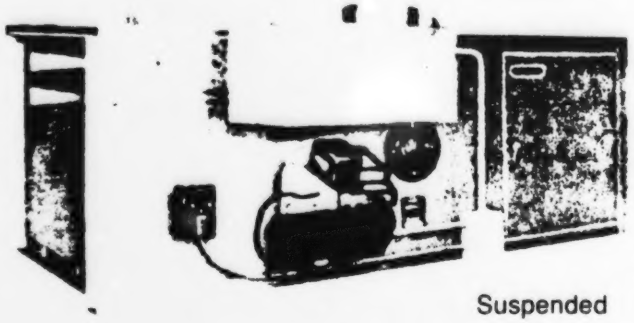
multi oil fired warm air furnace

TURNS WASTE OIL INTO FREE HEAT

The Multi-oil Furnace is Versatile

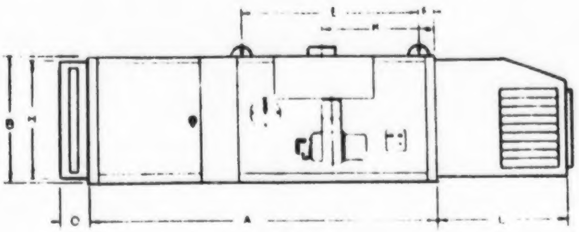


Highboy

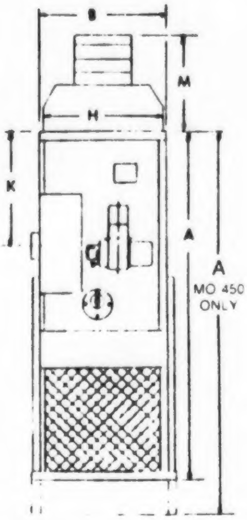


Suspended

SPECIFICATIONS AND DIMENSIONS



SUSPENDED



FRONT VIEW
HIGH BOY

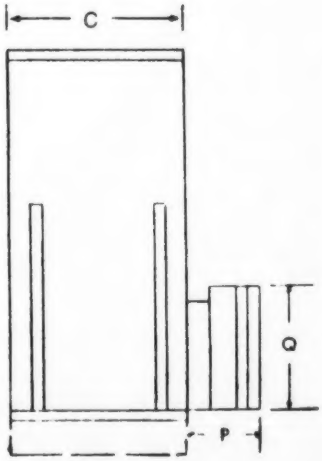
MODEL NO.		MO150	MO300	MO450
Length (S)	A	68	80	80
Height (HB)	A	69	81	85½
Width (HB) Height (S)	B	23	29	35½
Depth (HB) Width (S)	C	26½	36	38
Across Hangers (S)	D	18¾	28½	29¾
Between Hangers (S)	E	38½	41	40¾
Hanger Location (S)	F	2¾	3½	4
Plenum Conn. – Depth (HB) Plenum Conn. – Width (S)	G	24½	34	34½
Plenum Conn. – Width (HB) Plenum Conn. – Height (S)	H	21	27	33½
Flue Location – Side or Top (S & HB)	J	**	–	12
Flue Location – Side or Top (S & HB)	K	35*	–	26½
Discharge Head – Length (S)	L	24	30	36
Discharge Nozzle – Height (HB)	M	24	24(2)	28½(2)
Burner Extension (S & HB)	N	10	14	12
High Boy Adapter & Plenum Section (HB)	P	8-3/4	9-3/4	25-1/4
Plenum Section Dimension (HB)	Q	21-7/16 x 24-13/16	27-5/16 x 34-3/8	33-13/16 x 34-3/4

Plenum Connections on High Boy Adapter and Furnace are identical.

*Flue location in rear.

**8" from top of unit to centerline of rear flue connection.

†When ordering specify (S) for Suspended or (HB) for High Boy.



SIDE VIEW
HIGH BOY

MODEL	MO150	MO300	MO450
Output BTU HR at 83% efficiency	128,000	255,000	390,000
Input	150,000	300,000	450,000
Oil (140,000 BTU GAL) GPH	1.1	2.1	3.3
Burner Motor Size Oil Burner HP	⅛	⅛	⅛
Heating Surface Sq. Ft.	38	76	99
CFM Std. Air @ 85° Rise	1630	3050	4280
CFM Bonnet @ 150°F	1890	3540	4960
External Static Pressure In. W.C.	0.20	0.25	0.35
Approx. Blower Speed RPM	879	621	669
Blowers No. & Size In.	1-10	1-15	1-15
Blower Motor Size HP	⅓	¾	1
Flue Connection Dia. In. & Location	8 Rear	9 Box	12 Top
Required Draft at Breeching for Oil Firing	.04 to - .06		
Approx. Shipping Wt. Lb.	534	885	1095

Specifications and dimensions subject to change without notice

- **Versatile use**
- **Ductable**
- **Burns clean**
- **Quiet operation**
- **Controlled by wall thermostat**
- **One year limited warranty**
- **Listed for #1 & #2 fuel oil, used crankcase oil up to SAE 50 Wgt., and used automatic transmission fluid**
- **Easy installation**
- **No return line**
- **Combustion chamber in corrosion & heat resistant Stainless Steel**
- **Fully automatic**

We use standard parts in all our furnaces!

Off-the shelf, commonly used components that are available locally and stocked by your heating and plumbing shop.

Little or no service or maintenance required

Our new versatile waste oil heating system needs very little maintenance! The furnace needs to be cleaned only one or two times a year.

Affordable heating that results greater profits . . . comfortably!

Today's heating costs have more than tripled the costs of operating large, hard-to-heat work areas. Now you can reduce this costly overhead by installing our advanced waste oil heating system!

Burns #1 or #2 fuel oil, used crankcase oil up to SAE 50 Wgt., and used automatic transmission fluid. Our waste-oil system is not only inexpensive to operate . . it is smokeless and odorless . . . burning every drop of waste oil efficiently and completely to produce more measurable BTU's for less!

Flexible installation sites . . . even your ceiling is useable!

Suspended units can be "stowed away" in areas having little commercial value. They can be installed in attics, storage spaces, hung overhead, and even converted to high boy units when necessary.

No daily clean out!

Easily cleaned two to three times each year.

Enjoy

- Inexpensive Heat!
- Ease of Maintenance
- Quality Performance
- Safety
- Factory and field Tested for best results.

Forced Air 3 Models

150,000 B.T.U. - 300,000 B.T.U. - 450,000 B.T.U.

E.P.A. accepted method for waste oil disposal. (40 CFR 266)

National Fire protection agency

approves the burning of crankcase oils for heat in units that are listed for burning waste oil.

Standard #31 Section 1-10.1

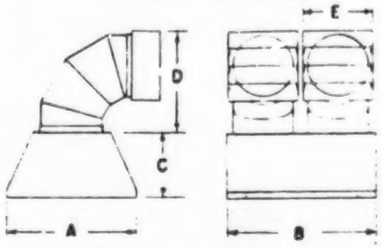
ETLM Listed

ETLM - Test Standard: 83-1

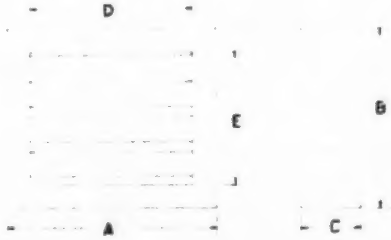
UL Test Standards: 296,727,731

OPTIONS

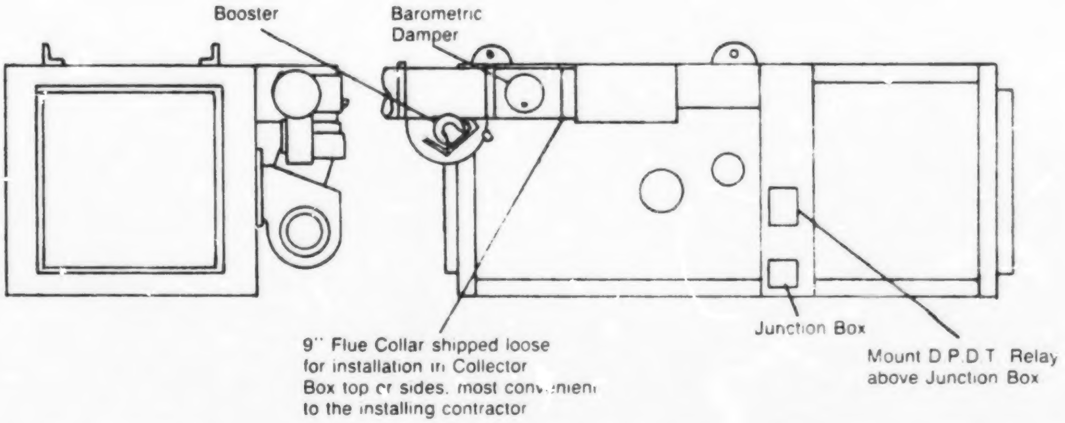
Air discharge plenum and nozzle assembly
suspended, HIGH BOY



Air discharge louver assembly
suspended



Where down draft is a problem or a chimney of sufficient height not practical, furnaces can be equipped as shown with an induced booster fan package available as optional equipment.


Booster
Barometric Damper
9" Flue Collar shipped loose for installation in Collector Box top or sides, most convenient to the installing contractor
Junction Box
Mount D.P.D.T. Relay above Junction Box

All furnaces come standard with: Transfer pump, oil filter, moisture filter for airline, pressure regulators.

ONE YEAR LIMITED WARRANTY — MADE IN U.S.A.

*Because of product improvements, we reserve the right to make design changes without notice or obligation.

AVAILABLE THROUGH:

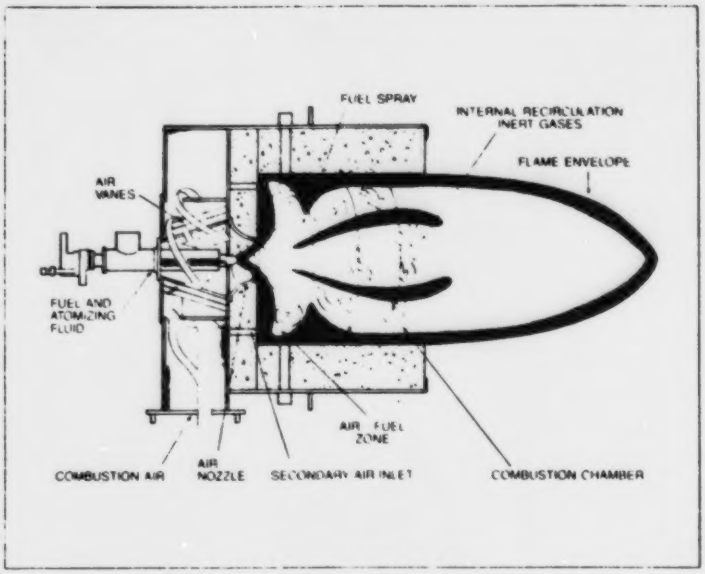
Multi-Fuel INC.

FRANKLIN COUNTY AIRPORT,
P.O. BOX 481, SWANTON, VT 05488

DISTRIBUTED BY

MULTI-FUEL
320 BELL
COWANSVILLE, QC J2K 3E2
(514) 263-1490

TRECAN
Low-Pressure Vortex burners



Schematic section of Vortex burner

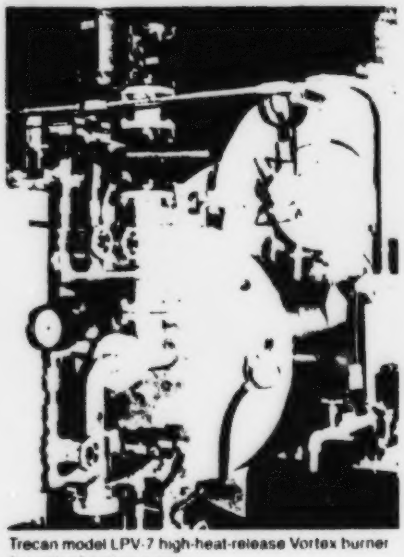
Trecan Low-Pressure Vortex (LPV) burners are manufactured to the highest industrial standards to provide clean, efficient combustion—with substantial energy cost savings.

With the LPV design, vortex action begins where combustion air is blown tangentially into the burner windbox. High rotational energy is imparted as the air accelerates through stationary swirl vanes, through the air nozzle, and then expands into the combustion chamber in a vortex action.

Gas, or finely-atomized liquid, is injected through a burner gun centered in the air nozzle. Extreme turbulence in the nozzle area provides excellent mixing of fuel with air. Mixing is intensified as hot gases recycle into the low-pressure zone, along the center line of the vortex flame.

This recycle mixing brings heat to the liquid-fuel injection area where liquid fuel is vaporized, mixed with combustion air and recycled gases, and heated to ignition temperature almost immediately.

The net result of the above is optimum combustion coupled with extremely short flame patterns.



Trecan model LPV-7 high-heat-release Vortex burner for natural and sour gas

Applications

LPV burners are in service firing process heaters, fired heat exchangers, boilers, kilns, paper dryers, rock dryers, spray dryers, incinerators, board dryers, calcining furnaces and air heaters. Wherever clean, extremely efficient combustion is required, LPV burners do the job.

Features

- Low combustion-air ΔP
- High turndown ratio—6:1 on gaseous or liquid fuels
- Multi-fuel capability: Most combustible gases, as low as 90 Btu/ft^3, most combustible liquids, as low as 4500 Btu/lb. Multiple fuels may be fired separately or in combination. For highly viscous liquids—up to 2500 SSU—special nozzles are available
- Low excess-air operation. Excess air is constant for turndowns of 3:1
- High-intensity, forced-draft design
- Short, high-swirl flame
- Low NO_x
- Pre-heated air capability, to reduce fuel consumption.

See over for technical data

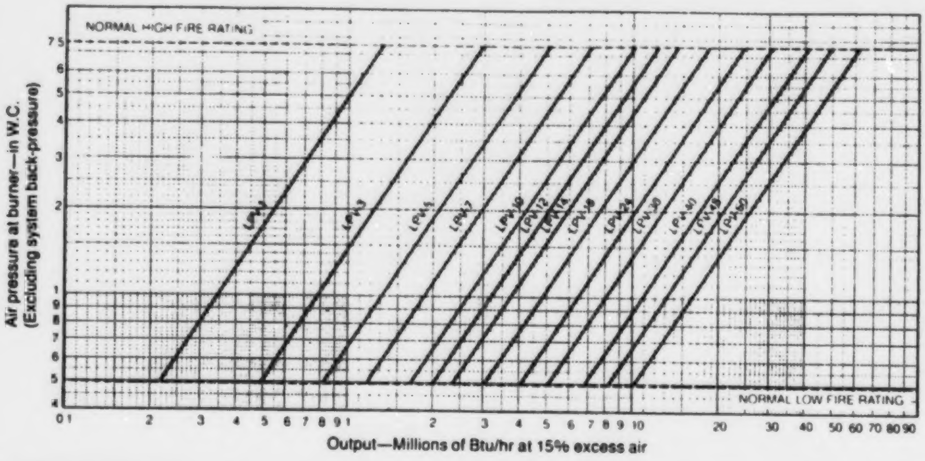
TRECAN LIMITED
THE CANADIAN COMBUSTION COMPANY

TRANE Thermal

LPV burners are manufactured in Canada, by Trecan, under licence from Trane Thermal Company, Conshohocken, Pa

Low-Pressure Vortex burners

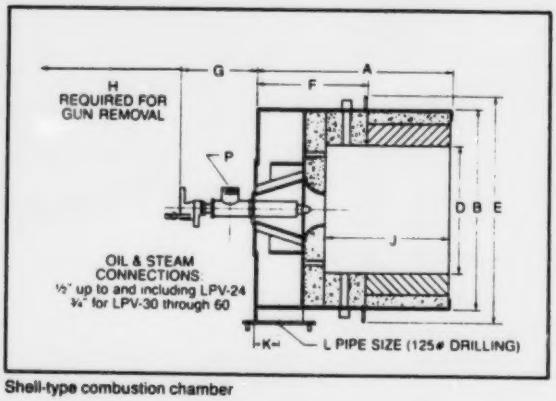
Burner capacities



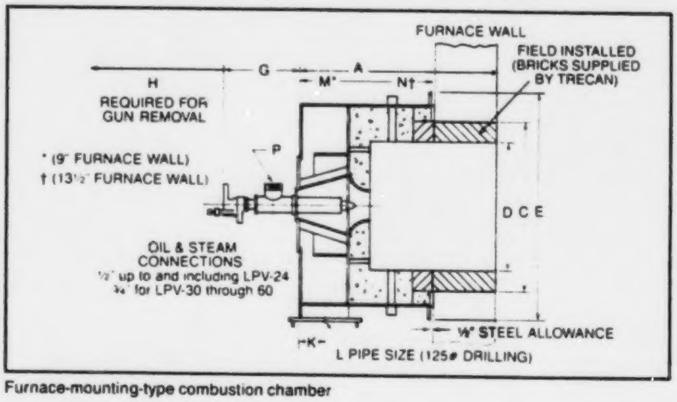
Notes

1. Fuel supply pressure*: 100 psig for fuel oils; 2 psig for standard gaseous fuels. *Pressures will vary for special fuels. Stated pressures are to be considered as regulated pressures.
2. Atomizing medium is either saturated steam at 110 psig, or compressed air for: No. 2 oil, as received at 110 psig; or No. 6 oil, heated to 200°F at 110 psig.
3. Preheated air: Up to 600°F, standard; or up to 1100°F, special (capacity curves will shift).

Physical data


G
A
F
H
REQUIRED FOR GUN REMOVAL
P
D B E
J
OIL & STEAM CONNECTIONS:
½" up to and including LPV-24
¾" for LPV-30 through 60
K
L PIPE SIZE (125# DRILLING)

Shell-type combustion chamber


FURNACE WALL
FIELD INSTALLED (BRICKS SUPPLIED BY TRECAN)
H
REQUIRED FOR GUN REMOVAL
G
A
M*
N†
* (9" FURNACE WALL)
† (13½" FURNACE WALL)
P
D C E
OIL & STEAM CONNECTIONS
½" up to and including LPV-24
¾" for LPV-30 through 60
K
¼" STEEL ALLOWANCE
L PIPE SIZE (125# DRILLING)

Furnace-mounting-type combustion chamber

MODEL	MM BTUH	A	B	C	D	E	F	G	H**	J	K	L	M	N	P	WT.
LPV-1	1.3	19¼	14½	—	10¾	—	6⅞	15⅛	17¼	12⅜	2¼	3	—	—	1½ NPT	400
LPV-3	3	28¼	30¼	24	15	36⅜	19⅛	15⅛	21⅛	18⅛	3	6	18¾	14¼	1½ NPT	1600
LPV-5	5	29⅜	33	27	18	39	20¼	17	23½	18⅛	3⅜	6	19⅞	15⅜	2 NPT	1800
LPV-7	7	35¾	36¼	30	21	47⅜	22⅛	17	25	22⅜	4⅜	8	26¼	21¾	2 NPT	2200
LPV-10	10	42¼	41⅜	35	26	47½	24⅛	17	26⅜	27⅛	5⅜	10	32¾	28¼	2½ NPT	3000
LPV-12	12	42½	43⅜	37	28	49½	24⅜	17	26⅜	27⅛	5½	10	33	28½	3"	3500
LPV-14	14	42½	43⅜	37	28	49½	24⅜	27½	36¼	27⅛	5½	10	33	28½	3"	3500
LPV-18	18	49¾	47⅜	41	32	53½	27⅛	27½	38⅞	31⅜	6⅞	12	40¼	35¾	3"	4000
LPV-24	24	55⅝	51⅜	45	36	57½	28½	29½	41⅜	36¼	7⅝	14	46⅛	41⅜	4"	4500
LPV-30	30	62	57½	51	42	63⅜	30⅜	29½	43	40¾	8½	16	52½	48	4"	5800
LPV-40	40	74¾	63½	57	48	69⅜	34⅛	30½	45⅞	49¾	10⅜	20	65¼	60¾	4"	8000
LPV-48	48	79½	72⅛	65	56	77¾	39⅛	30½	50¾	49¾	10⅜	20	69¾	65¼	6"	11000
LPV-60	60	97¾	82½	72	63	87⅜	43⅜	37	63	63	12¾	24	88	83½	6"	19300

*125 lb. flange drilling

**Removal dimension shown is maximum for oil-fired burners, but will be less for gas-fired burners. Certified dimensions supplied upon request.

TRECAN LIMITED
THE CANADIAN COMBUSTION COMPANY

4540 Dixie Road
Mississauga, Ontario L4W 1N2
Phone: (416) 625-4030
Telex: 06-961261

7575 Trans Canada Hwy., Suite 305
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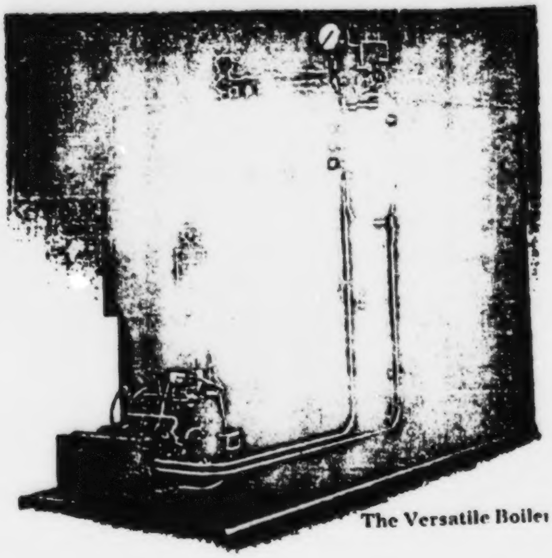
Hot Water Boiler, Low Pressure Steam Boiler

- NO DAILY CLEAN OUT!
- SAFETY BUILT IN
- INDUSTRIAL QUALITY
- BUILT FOR TOP EFFICIENCY



The Versatile Boiler

- FOUR MODELS

  B-5000 B-8000
  B-6000 B-9000

- EASY INSTALLATION
- FULL WARRANTY

  (See page 2)

- LISTED FOR

  #1 or #2 Fuel Oil,
  Crankcase Oil,
  Transmission Oil
  Only

- BURNS THE OIL – NOT THE VAPORS!
- BURNS CLEAN – NO SMOKE!

- ENJOY THESE FEATURES:
  - Economical Heat
  - Ease of Maintenance
  - Quality Performance
  - Safety
  - Factory and Field Tested for best results.

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"Built in accordance
with the requirements
of the ASME Boiler
and Pressure Vessel
Code."

Burner Listed By.
ENERGY TESTING
LAB OF MAINE
to U.L. 296
specifications

Your Local Dealer Is:

"STATISTICS OF CLEAN BURN BOILERS"

MODEL:	B-5000	B-6000	B-8000	B-9000
TYPE OF HEAT:	HOT WATER OR LOW PRESSURE STEAM			
APX. B.T.U.H. RATING :	500,000	680,000	800,000	930,000
OIL CONSUMPTION RATE :	3.8 GPH	4.7 GPH	5.5 GPH	6.4 GPH
ELECTRIC POWER:	ALL UNITS 115V.-A.C. 60 Hz.			
WATER CAPACITY: (gallons)	90	112	132	153
STACK SIZE:	ALL UNITS: 7 inches			
SIZE: HEIGHT:	55¼	55¼	55¼	55¼
WIDTH:	33¼	33¼	33¼	33¼
LENGTH:	47½	54½	65	72
SHIPPING WEIGHT:	1700lbs.	1900 lbs.	2100 lbs.	2600
COLOR:	ALL UNITS: INDUSTRIAL BLUE			
WARRANTY:	ONE YEAR ON ALL PARTS			

*B.T.U.H. rating may vary slightly depending on your oil

*Check all state and local codes before installation.

MANUFACTURED BY: **CLEAN ENERGY, INC.**
83 South Groffdale Road
Leola, PA. 17543

1-(717)-656-2011

FOR SALES AND DEALERSHIP INFORMATION:

OUTSIDE WASHINGTON STATE: 1-(800)-331-0183
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